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RESEARCH REPORTS

March 18, 1960
Vol. 33. No. 3

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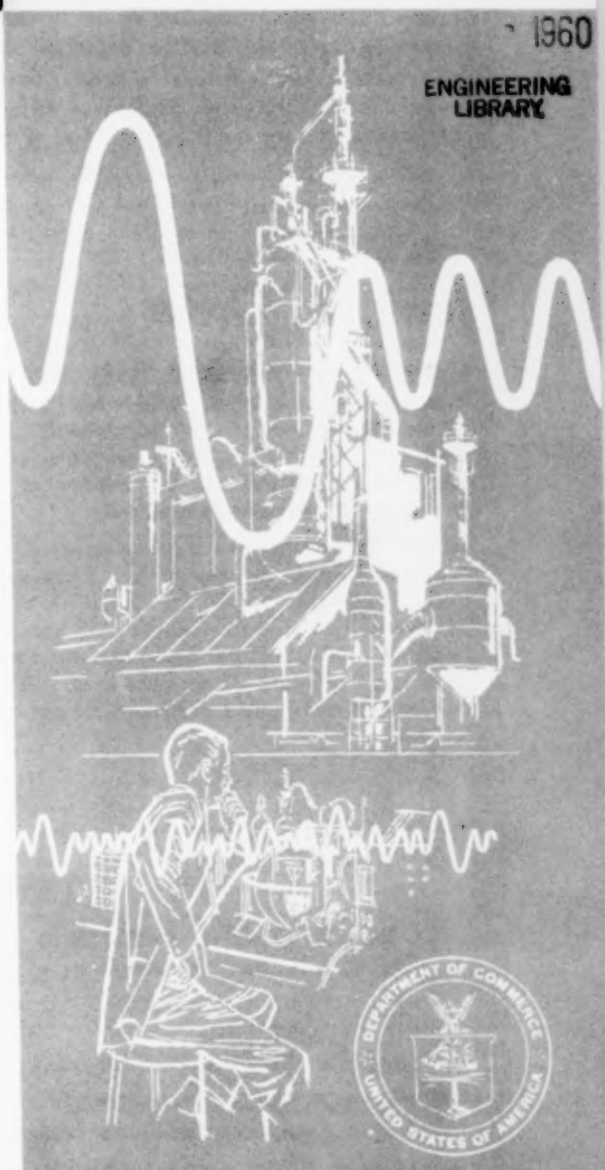

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Basic research in the Navy. A report to the Secretary of the Navy. June 59. 2 vols. (PB 151 925) $7.00 329

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U. S. DEPARTMENT OF COMMERCE

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U. S. Government RESEARCH REPORTS

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BIBLIOGRAPHY

Edo Corp., College Point, N. Y.
BIBLIOGRAPHY OF REFERENCES RELATED TO HYDRO-SKI LOADS, by L. Kaplan. Rept. on Contract NOas 56-376-c. 16 Feb 59, 82p. 622 refs. Rept. no. 4438; AD-216 363.
Order from LC mi$4.80, ph$13.80 PB 144 303

The references listed are the result of a survey of hydro-ski literature, including reports on model, full scale and theoretical data. Since it was felt that some of the experience acquired in the development of hull seaplanes would be useful to the objectives of the subject contract, this bibliography contains a number of listings related to hull seaplane investigations.

ASTRONOMY

Astrophysics

Centro di Studio per la Fisica Delle Microonde (Italy).
ON THE VELOCITY OF METEORS DURING THEIR EVAPORATION, by F. Verniani. Technical note no. 1 on Contract AF 61(052)227. June 59, 9p. 5 refs. AFCRC-TN-59-575.
Order from LC mi$1.80, ph$1.80 PB 143 976

From Herlofson's equations for meteoric evaporation, it is deduced that part of the meteors cannot evaporate completely, owing to their excessive loss in speed; moreover, it is shown that the flight of all meteors is considerably retarded during the entire process of evaporation.

Flower [Astronomical] Observatory [Philadelphia] Pa.
W URSAE MAJORIS SYSTEMS, by L. Binnendijk. Final rept. on Contract Nonr-2320(00). [1958] 9p.
Order from LC mi$1.80, ph$1.80 PB 143 715

Princeton U., N. J.
ON THE MECHANISMS OF METEORIC ABLATION, by Sin-I Cheng. Rept. on Contract AF 18(600)498. Apr 58, 37p. 14 refs. Rept. no. 427; AFOSR-TN-58-649; AD-162 181.
Order from LC mi$3.00, ph$6.30 PB 144 042

The deceleration of the meteor and the presence of a molten layer over the meteoric body results in an unstable liquid-gas interface that leads to the direct loss of mass as liquid droplets flying away from the meteoric surface. The feasibility of this mechanism is analytically shown and demonstrated with typical examples. By incorporating the present mechanism, the irregularity of the meteoric luminosity when compared with the calculated results of Opik's theory may be qualitatively explained and the occasional burst or flare of some meteors may be visualized. Several other observations of the meteoric phenomena also tend to verify the plausibleness of the proposed mechanism. (Portions of this report are illegible)

University of Southern California. Engineering Center, Los Angeles.
PRODUCTION OF CARBON IN THE UPPER ATMOSPHERE, by K. P. Chopra. Technical note on Contract AF 18(603)95, 31 July 59, 11p. 10 refs. USCEC rept. 56-208; AFOSR-TN-59-902.
Order from LC mi$2.40, ph$3.30 PB 144 474

This technical note describes a process by which penetrating cosmic rays may produce atomic carbon in the upper atmosphere. High energy cosmic ray particles bombard the atoms and molecules of the upper atmosphere and release neutrons along with other products of disintegration. Some of these neutrons escape outwards and undergo a natural free decay. Some others may collide with nitrogen atoms and produce atomic carbon with the release of a proton. These carbon atoms are radio-active and decay back into atomic nitrogen with the release of a high energy electron. But the fairly long lifetime (5569 years) ensures a copious supply of carbon atoms in the upper atmosphere. The other products of this process, viz. protons and electrons, may get trapped in the earth's magnetic field, and hence contribute to the formation of the inner radiation belt.

BEHAVIORAL SCIENCES

Human Engineering

Educational Research Corp. [Cambridge, Mass.]
A SET OF DISCRIMINABLE SURFACE COLORS ANI SYMBOLS FOR CODING IN ANIMATED TRAINING PANELS, by Milton W. Horowitz and Robert Fromer. Rept. on Contract N61339-294. 5 May 59, 22p. 4 refs. Technical rept. NAVTRADEVCEN 20-OS-52.
Order from LC mi$2.70, ph$4.80 PB 143 821

This study, developed a simple reliable experiment to measure color discriminability, and also identified 15 colors and 10 symbols each of which is easily differentiated from the others. While alternate sets of colors might be found which are also highly discriminable, the 15 present colors should prove extremely useful to the equipment designer.

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
A COMPARISON OF ONE-, TWO-, AND THREE-MAN CONTROL UNITS UNDER VARIOUS CONDITIONS OF TRAFFIC INPUT RATE, by J. S. Kidd. Rept. on Contract AF 33(616)3612. June 59, 22p. 20 refs. WADC Technical rept. 59-104; AD-225 965.
Order from OTS $0.75 PB 161 045

The performance of various sized pattern-feeder approach control teams was compared under three conditions of input load in a simulated air traffic control situation. Conditions in which either one, two, or three men operated the system were compared. Input loads were 90 sec, 60 sec, or 30 sec average interval between aircraft arrivals. Nine laboratory-trained controllers participated in a total of 54 problems. Results indicated a consistent decrement in performance as a function of increased input load. Crew augmentation led to only moderate facilitation of performance when the input load to the system was held constant and the number of controllers was increased. When input load was increased proportionately to the size of the control unit, there was a marked decline in system performance. It was concluded that simple crew augmentation imposes coordination demands that interfere with primary task activities. Maximum autonomy of system operators was recommended.

Personnel and Training

Harvard Graduate School of Education, Cambridge, Mass.
POSITION CHOICES AND CAREERS: ELEMENTS OF A THEORY, by David V. Tiedeman, Robert P. O'Hara (Boston Coll.) and Esther Mathhews (Newton High School). Rept. no. 8 on Harvard Studies in Career Development, Technical rept. no. 4 on Contract Nonr-1866(31). 12 Dec 58, 53p. 61 refs. AD-217 191.
Order from LC mi$3.60, ph$9.30 PB 144 464

An attempt is made to organize, in a preliminary manner, previous writing in the field of vocational psychology relating to perceptions of self and of work as variables intervening between prior circumstances and career decisions.

Human Resources Research Office, George Washington U., Washington, D. C.
SOME PROBLEMS IN THE ANALYSIS OF TROUBLE SHOOTING BEHAVIOR, by Paul G. Whitmore (Army Air Defense Human Research Unit) Research rept. 2 on Contract DA 49-106-qm-1. Oct 59, 27p. 7 refs.
Order from LC mi$2.70, ph$4.80 PB 144 234

Data from three previous HumRRO studies (RADAR IV, RADAR VI, and ACHILLES) were pooled and analyzed to identify problems of maintenance and maintenance training. The data consisted of (1) observations of maintenance activities made during the administration of job-sample proficiency tests to M33 and NIKE AJAX fire control system maintenance technicians, and (2) responses to multiple-choice items on a written test given to NIKE AJAX fire control system maintenance technicians. The set of coded categories used in recording activities did not meet the requirements for describing the technician's trouble shooting procedures; consequently, the technician's knowledges and skills could not be clearly inferred. It was not possible to isolate "knowledge" classes for the written test items related to over-all proficiency. The generalization of modifications introduced into the M33 FCS experimental training programs to NIKE AJAX IFC training was supported at a very gross level of analysis.

Human Resources Research Office, George Washington U., Washington, D. C.
WHAT HumRRO IS DOING, JANUARY 1956-JUNE 1957. Dec 57, 56p. 19 refs. Research Bulletin 4; AD-158 174.
Order from LC mi$3.60, ph$9.30 PB 138 229

Psychology

Army Medical Research Lab., Fort Knox, Ky.
PERCEPTION OF RELATIVE FREQUENCY AS A FUNCTION OF THE NUMBER OF STIMULUS AND RESPONSE CATEGORIES, by R. A. Gardner, J. B. Forsythe and others. Rept. on Psychophysiological Studies. 7 Apr 58, 18p. 7 refs. Rept. no. 328.
Order from LC mi$2.40, ph$3.30 PB 144 221

A prediction response was used to study the perception of relative frequencies of serially presented stimulus-events when the only predictable property was relative frequency. The number of stimulus-event categories was varied from two to eight. Each stimulus-event category was associated with a different response category. The relative frequency of the response to the most frequently presented category was a function of the number of categories. Asymptotic response levels were reached, if at all, only very late in the series of 420 trials. For the last 140 trials all groups with more

than three categories were responding at frequencies significantly different from those of the presented stimulus-event categories.

[Behavior Research Lab., Washington U., St. Louis, Mo.]
THE EFFECT OF ELECTROCONVULSIVE SHOCK ON MALE ALBINO RATS WITH EXPERIMENTALLY INDUCED SENSORY DEFICITS, by John A. Stern and David McDonald. Progress rept. on Contract Nonr-816(06). 31 Dec 58, 17p. 41 refs.
Order from LC mi$2.40, ph$3.30 PB 144 182

The major hypothesis of this experiment is that if ECS animals are more reactive to environmental stimuli, then if one makes them blind, deaf, or anosmic, they will behave more like normal controls. The experimental design constitutes, in the opinion of the author, a clear-cut test of this hypothesis.

Bureau of Applied Social Research, Columbia U., New York.
GROUP AND INDIVIDUAL PERFORMANCE IN PROBLEM SOLVING RELATED TO PREVIOUS EXPOSURE TO PROBLEM, LEVEL OF ASPIRATION, AND GROUP SIZE, by Irving Lorge and Herbert Solomon. Technical rept. no. 3 on Contract Nonr-266(43). 15 Dec 58, 32p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 144 179

The experiment reported here was designed to test the hypothesis that previous exposure with the problem would significantly affect the proportion of individual solutions and, hence, the proportion of group solutions. Perhaps the variance of proportions of group solutions developed in this paper under the assumption that the ability model is operating may be helpful in choosing among several explanations of group performance.

Institute of Educational Research, Indiana U., Bloomington.
A CATALOG OF TROUBLE SHOOTING TESTS (SURVEY OF TESTS DEVELOPED TO DECEMBER 1956) by Nicholas A. Fattu. Research rept. no. 1 on Contract Nonr-908(07). Dec 56. 136p. 148 refs. AD-153 754.
Order from LC mi$6.90, ph$21.30 PB 144 377

The trouble-shooting tests include (1) on-the-job measures, (2) performance tests, (3) mockup or simulator tests, (4) automatic recording of checks (ARC) or tab-type tests, and (5) pencil-paper and oral-interview tests. The first section considers the measures that were taken on the job under normal operating conditions. Those measures differ from the trouble-shooting performance tests in that the latter structure and control both the tasks and the situations in which they occur. The simulator tests tend to have the same kinds of tasks as those used in the performance tests. The ARC type tests attempt to translate some of the features of the simulator tests into pencil-paper form. The examples of the trouble-shooting tests were located mainly in bibliographic sources and publications by the Department of Defense.

Institute of Psychiatry, Maudsley Hospital, London (Gt. Brit.)
RATE OF TEMPORAL AND SPATIAL INHIBITION IN HYSTERIA AND BRAIN DAMAGE IN NORMAL, NEUROTIC AND BRAIN-DAMAGE SUBJECTS. Final technical rept. for 1 May 58-30 Apr 59 on Contract DA 91-508-EUC-311. [1959] 35p. 36 refs.
Order from LC mi$3.00, ph$6.30 PB 143 837

Section 1. Introduction; Section 2. Selection and description of subjects; Section 3, A detailed consideration of the tasks used.

Laboratory for Research in Social Relations, U. of Minnesota, Minneapolis.
THE EFFECT OF STATUS ON ABILITY TO INFLUENCE GROUP SOLUTIONS OF PROBLEMS, by Henry W. Riecken. Technical rept. no. 1 on Research Studies on the Relation Between Cognition and Behavior, Contract N8onr-662(16). Jan 58, 16p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 138 292

An experiment in which 32 four-man groups discussed "human relations problems" provided an opportunity to test a finding of Bales and others that the discussant who talked the most contributed most to the solution of the problem. By providing a hint about a uniquely good, insight solution to one problem, and by differentially locating that hint in the hands of either the highest or the lowest talker in the group, an opportunity was afforded to assess both the perceived and the actual contribution of the "top man" compared to the "bottom man." The results show that top men are almost uniformly perceived as contributing more, and that they are in fact more influential in getting the "elegant solution" (contained in the hint) accepted by the group. Further data suggest that the differential ability of top men to exert influence is related more to their ability to win attention and support from the group than it is to their ability to reduce opposition. Personal characteristics of top men that may lead to their achieving that position are only suggested by our data, but there is some reason to believe that clarity and fluency of expression are important factors, but that measured intelligence is not.

[Laboratory for Research in Social Relations] U. of Minnesota, Minneapolis.
RESEARCH ON COHESIVE AND DISRUPTIVE TENDENCIES IN COALITION TYPE GROUPS, by Ben Willerman. Final technical rept. on Contract N8onr-662(16). 1957, 7p. 6 refs.
Order from LC mi$1.80, ph$1.80 PB 138 288

This final report is a summary of some aspects of cohesive and disruptive tendencies in coalition-type groups which have emerged from our research. The conclusions of studies of individual attraction to group activity relative to individual activity are presented. Some by-products of the research are briefly described.

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
THE EFFECT OF TEAM SIZE AND INTERMEMBER COMMUNICATION ON DECISION-MAKING PERFORMANCE, by Robert G. Kinkade and J. S. Kidd. Rept. on Contract AF 33(616)3612. Apr 59, 16p. 10 refs. WADC Technical rept. 58-474.
Order from OTS $0.50 PB 151 967

The performance of single individuals, two-man teams without intercommunication, and two-man teams with intercommunication was compared in a complex decision-making task. The task was an operational "game" derived from radar approach control. Forty-eight students participated. The experimental design utilized a subject x conditions balanced Latin square having six independent replications. Two-man team performance was superior to that of single individuals, but not proportionately so. Interpretation of the data in terms of productivity per person showed the person working alone to be significantly superior to the person working in a two-man team. Teams with communication were slightly superior to teams having no communication. The explanation of the results of the individual vs. individuals in a team comparison is hypothesized to lie in the diversion of time and productive capacity in the team situation away from the prime task and into integrative and coordinative behavior.

Princeton U., N. J.
THE ROLE OF THREE PROCESSES IN DETERMINING RESPONSES TO INTERPERSONAL DISAGREEMENT, by Harold M. Schroder and David E. Hunt (Yale U.). Technical rept. no. 5 on Contract Nonr-[1858(12)] and Public Health Grant M-955. Jan 59, 127p. 52 refs.
Order from LC mi$6.30, ph$19.80 PB 144 273

The present report will propose three conceptual processes as units for mediating dispositional and situational effects. The general characteristics of a process will be described in Section II. Although our major consideration in developing these processes was the coordination of dispositional and situational factors, we also believe that such processes should be congruent with developmental determinants. Therefore in addition to describing the specific processes in Section III, we will also discuss the relationship of each process to a specific set of child-rearing antecedent conditions. The remaining sections are then given over to several studies aimed at evaluating the construct validity of the viewpoint.

School of Aviation Medicine, Brooks AFB, Tex.
FACT AND FANCY IN SENSORY DEPRIVATION STUDIES, by Jerrold L. Wheaton. Aug 59, 62p. 211 refs. Aeromedical Reviews no. 5-59.
Order from LC mi$3.90, ph$10.80 PB 144 225

This discussion is not intended to be exhaustive, and more detailed information can be obtained from the cited references (202, 203, 206, 208). The broader issues, in which the problem has been studied, are outlined in chapter III, entitled "The Nature of Isolation." Chapters IV and V consist of summaries of published reports, first, of the autobiographic, anecdotal, and clinical literature, and then, of the experimental literature. The final chapters consist of a summary of the present knowledge of isolation effects on human behavior and a discussion of probable military implications.

Yale U., New Haven, Conn.
AN EXPLORATION OF THE INTERRELATIONS AMONG SOME NON-INTELLECTUAL PREDICTORS OF ACHIEVEMENT IN PROBLEM SOLVING, by Paul C. Berry. Technical rept. no. 4 on Contract Nonr-609(20). Dec 58, 50p. 19 refs. AD-218 598.
Order from LC mi$3.30, ph$7.80 PB 143 856

In considering the interrelations among non-intellectual variables and achievement in problem solving, particularly the sex role, the following hypotheses were tested: (1) compared to women, men are more favorable in attitude toward analytic thinking, less likely to conform, less field dependent, less anxious, and more masculine; (2) each of these nonintellectual variables is correlated with achievement in problem solving among men and women; (3) each of these correlations between a nonintellectual variable and problem solving remains significant even though the effects of mathematical and verbal aptitudes are partialled out; (4) whatever variance these non-intellectual variables have in common with problem solving but not in common with verbal and mathematical aptitude, they have in common with each other; (5) the concept of sex role may be used to account for the variance which is common to problem solving and to these other non-intellectual variables, but not to verbal and mathematical aptitude; and (6) to significant sex differences in problem solving remain when the effects of differences in sex-role identification are controlled. Analysis of data from 20 problems together with 8 different tests administered to 55 men and 49 women confirmed the first, second and sixth hypotheses (except with respect to tendency to conform), rejected the fourth and fifth hypothesis, and gave partial confirmation to the third.

BIOLOGICAL SCIENCES

Detroit Arsenal, Center Line, Mich.
AN INVESTIGATION OF THE PAPER CHROMATOGRAPHY TECHNIQUE FOR DETERMINING THE UTILIZATION OF SACCHARIDES BY FUNGI, by C. Bruce Lee. 1 May 58, 54p. 9 refs. Rept. no. 4135 (Final).
Order from LC mi$3.60, ph$9.30 PB 143 912

Object was to determine the applicability of paper chromatography as a research technique in the utilization of certain saccharides by selected species of fungi. Investigations were conducted on representative examples of monosaccharides, disaccharides and trisaccharides. Estimations of fungus utilization of saccharides were accomplished by changes in the rf values of the saccharides on filter paper strips compared with rf values of the saccharides with the standards also on filter paper strips. Conclusions regarding saccharide utilization were derived using standardized solvents, developing agents and standard testing conditions and

equipment. Paper chromatography techniques revealed that many of the more complex saccharides were altered by exposure to fungus action.

Maryland U., College Park.
STUDIES ON PARASITIC ACARINA AT NAMRU NO. 3, by G. W. Wharton and Conrad E. Yunker. Final rept. for 1 Sep 55-31 Dec 57 on Contract Nonr-1809(00). 31 Dec 57, 3p. 7 refs. AD-150 762.
Order from LC mi$1.80, ph$1.80 PB 138 203

Descriptions were found in the literature for over 350 species of parasitic mites of Egypt. Over 700 collections of parasites from hosts in various Egyptian localities were obtained. Nine cultures of endemic laelapid and dermanyssid mites were initiated and successfully maintained in the laboratory. The natural host of Ophionyssus natricis was found. An investigation of the nasal mites of Egyptian amphibians showed that over 95% of the toads were infected. Over 800 specimens of East African animals were examined. Among the parasitic mites which were collected were chiggers in the nasal cavities of a number of genera of rodents, and a new genus and species of ewingid mite from pagurid crabs. On the basis of material collected in East Africa, the sequence of infection and pathological picture of knemidokoptic mange in parakeets was determined. Results of an ecological study of rodent-mite population in the deserts and semidesert areas near Cairo indicated that: (1) the great daily extremes of the general climate are not reflected in the climate of the burrows, this microclimate being vastly more stable and essentially different than that of the exterior: (2) the burrow and host represent the entire effective environment of the mite populations, while the ticks are subject to the excesses of the external environment as well; (3) no seasonal variations in mite populations, which could be separated from the influence of other factors, could be demonstrated, while the ticks exhibit a definite seasonal variation reflecting the influence of the environment external to the burrows; (4) the host is probably the most important environmental factor in the abundance and distribution of mite populations; (5) area (desert of semidesert) plays a determining role in the variability of these populations.

Pittsburgh U., Pa.
BIOPHYSICAL INVESTIGATIONS ON BACTERIOPHAGES, by Irwin J. Bendet and Max A. Lauffer. Technical rept. no. 6, 1 Jan-31 Dec 58, on Contract Nonr-624(03). [1958] 4p. 2 refs.
Order from LC mi$1.80, ph$1.80 PB 144 259

During the past year this laboratory has continued to work on the following problems: (1) explanation of the dual sedimentation phenomenon manifested by T2 bacteriophage; (2) determination of the hydration of Escherichia coli, Southern bean mosaic virus, and a few other representative viruses. (See also PB 138 645)

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
SUSTAINED OPERANT BEHAVIOR IN MICE; A MODEL FOR BEHAVORIAL RESEARCH IN BIO-SATELLITES, by Frederick H. Rohles, Jr. and Marvin E. Grunzke. Rept. on Human Performance in Advanced Systems; figures drawn by U. of Dayton on Contract AF 33(616)6264. Aug 59, 14p. 3 refs. WADC Technical note 59-299.
Order from OTS $0.50 PB 161 298

A male C-57 BL mouse was trained to respond on a fixed-ratio-100 operant reinforcement schedule for 20 minutes out of every 6 hours. The subject was isolated and performed on this schedule for food reward for 96 hours. The feeder in the operant chamber was disconnected and performance was observed under extinction conditions without food for an additional 96 hours. The results of the study showed that the response rate during the 96-hour reinforced session was high and consistent from work period to work period. Meaningful performance data were also obtained under extinction conditions. The study illustrates a potential method of obtaining meaningful behavioral information from animals in orbital flight.

Army Chemical Warfare Labs., Army Chemical Center, Md.
CONFERENCE ON ENVIRONMENTAL PHYSIOLOGY 10 AND 11 APRIL 1958, by F. N. Craig. Oct 58, 29p. CWL Special Pub. 2-11; AD-219 200.
Order from LC mi$2.70, ph$4.80 PB 138 259

Author abstracts of papers presented at the conference.

Army Medical Research Lab., Fort Knox, Ky.
DERIVATION OF 'SUBJECTIVE VELOCITY' FROM ANGULAR-DISPLACEMENT ESTIMATES MADE DURING PROLONGED ANGULAR ACCELERATIONS: ADAPTATION EFFECTS, by S. J. Ceran and F. E. Guedry, Jr. Rept. on Psychophysiological Studies. 20 Feb 59, 24p. 20 refs. Rept. no. 376.
Order from LC mi$2.70, ph$4.80 PB 144 222

Subjective estimates of angular displacement of a target light fixed with respect to the observer were made during prolonged constant angular acceleration of the entire body in a dark room. These estimates provided an indication of subjective velocity throughout the course of the vestibular reaction. Results obtained from 10 subjects indicated that subjective velocity rises and then declines during the course of a constant angular acceleration. Within the range of stimuli applied (0.5 deg/sec^2 to 2.0 deg/sec^2) 'rise' time to maximum subjective velocity appears constant regardless of stimulus magnitude. The maximum attained and the rate of change of subjective velocity up to this maximum are directly related to the magnitude of the angular acceleration. However, after about thirty seconds of constant angular acceleration, the subjective velocity declines even though the angular acceleration remains constant. Implications of

certain characteristics of the results for the torsion pendulum theory are discussed.

Army Medical Research Lab., Fort Knox, Ky.
EFFECT OF CHANGES IN RENAL BLOOD FLOW RATE AND VASCULAR INTRALUMINAL PRESSURE UPON RENAL VASCULAR RESISTANCE, URINE AND LYMPH FLOW RATES, by F. Haddy, J. Scott and others. 27 Jan 58, 74p. 24 refs. Rept. no. 323; AD-151 369.
Order from LC mi$4.50, ph$12.30 PB 138 333

Renal artery pressure change above 80 mm Hg results in active change in vessel geometry due to a direct effect of variation in transmural pressure upon vascular smooth muscle. Vein pressure change is followed by active vasomotion invoked reflexly over nonlocal sympathetic nerves and passive vasomotion induced by variation in transmural pressure dependent upon stromal rigidity. The peculiar changes in urine flow and glomerular filtration rates which follow variation of veni and artery pressures likely are related to these resistance controlling mechanisms.

Hofstra Coll., Hempstead, N. Y.
AUDITORY PAIN THRESHOLDS FOR INTERMITTENT, "BEAT", AND STEADY TONES, by Robert Plutchik. Rept. on Contract Nonr-2252(01). Dec 58, 31p. 21 refs.
Order from LC mi$3.00, ph$6.30 PB 143 926

The major findings were as follows: (1) Individual pain thresholds varied from about 100 db to over 130 db. Unpleasantness thresholds averaged about 8 to 10 db below pain thresholds. This difference turns out to be the same as that required for a half-loudness judgement as reported in the literature. (2) The 2500 cps tone, irrespective of whether it is presented as a series of pulses, a series of beats, or as a steady tone, is reacted to as "unpleasant" or as "painful" at a slightly, but consistently lower intensity level than the corresponding 1000 cps tone. (3) At each frequency used, intermittent tones are judged as "unpleasant" or "painful" at lower intensity levels than steady tones. The differences are slight but consistent. (4) Repetition rates of 3 pulses or beats per second are fairly consistently found to have a lower unpleasantness and pain threshold than either 6 or 15 per second. Each of these findings was found to be consistent with various reports in the literature.

Institut für Animalische Physiologie der J. W. Goethe Universität (West Germany).
INVESTIGATIONS ON THE FLOW OF BLOOD IN CAPILLARIES, by Rudolf K. Zahn. Final technical status rept. for 1 Oct 58-30 Sep 59 on Contract DA 91-591-EUC-921. [1959] 22p. 20 refs.
Order from LC mi$2.70, ph$4.80 PB 144 253

A method for simultaneous recordings of (1) heart rate, (2) ECG amplitude, (3) speed of blood flow and (4) haematocrit has been developed for the tranquilised frog. Different tranquilisation pharmaca have been investigated. MS 222 and Curarine proved to be of limited value, whereas Succinylic choline seems to be by far the best. The better the oxygen supply the shorter the tranquilisation time. There is a slow steady drop with time in heart rate and ECG amplitude, in tranquilised animals. No direct dependance of capillary flow on temperature change and/or heart action could be established. Ultra violet (UV) irradiation of small areas of the swimming skin does not influence heart action.

International Research Associates, New York.
EXPECTATIONS AND PERCEPTIONS WITH RESPECT TO THE MARINE CORPS RESERVE (GROUND). Technical rept. no. 7 on Training Problems on the Marine Corps Reserve, Contract Nonr-1654(00). July 57, 23p. AD-135 458.
Order from LC mi$2.70, ph$4.80 PB 138 233

An inquiry is made into the reservists' motivations to participate in the Marine Corps Reserve. A questionnaire was administered to 1048 reservists in the metropolitan New York area divided into a low-ranking group of privates, privates-first class, and corporals, and a high-ranking group of the higher noncommissioned officers and commissioned officers. The respondents were given a list of 22 positive and negative qualities which they were to attribute to the Army, Navy, Air Force, and Marine Corps as they believed applicable. The term "undemocratic" was applied very few times to any of the reserves. The Marine Corps Reserve was credited with each of the positive attributes more often than the other reserves except that "modern" was applied more often to the Air Force Reserve. The dominant distinguishing elements of the Marine Corps Reserve image were "tough discipline" "makes a man out of you"; and "very traditional." The negative attributes which distinguish the other Reserves from the Marine Reserve are that the others "don't know how to wear uniforms"; "have no discipline"; and "for just ordinary guys." "Good military training" was attributed most often to the Marines and "very democratic" least. Of the 10 attributes most frequently applied to the Air Force Reserve, 5 were positive. The Navy Reserve is the second most favored; 7 out of the 10 attributes most frequently applied were positive. The Army is at the lowest end of the spectrum of esteem; 9 of the 10 attributes most frequently applied were negative. The one positive attribute was "patriotic." The criticisms recorded for the Marine Corps Reserve were chiefly lax discipline, poor work organization, and low caliber of reserve training. None of the reservists were so dissatisfied that they would drop out.

Iowa State U., Iowa City.
PULMONARY BLOOD VOLUME AND CIRCULATORY ALTERATIONS IN DOGS EXPOSED TO COMPENSATED HIGH INTRAPULMONARY PRESSURES, by Jack Williams and Steven M. Horvath. Rept. on High Altitude Physiology, Contract AF 33(616)5173. Apr 59, 18p. 34 refs. WADC Technical rept. 58-471; AD-215 622.
Order from OTS $0.50 PB 151 966

Dogs were placed in full pressure suits and helmets and exposed to pressures from 4 to 230 mm. Hg for periods ranging from 2 to 300 minutes. The measured cardiovascular alterations increased with prolonged

exposure times. Pulmonary blood volume increased while the animal was breathing 100% oxygen at 4 to 8 mm. Hg pressure. The pulmonary blood volume began to decrease at a pressure of 140 mm. Hg. All increased pressures caused a decreased cardiac index and increased systemic resistance. The pressure suit used in these studies does not offer complete and prolonged protection to the animal exposed to compensated high breathing pressures.

Minnesota U., Minneapolis.
A DISCRIMINANT ANALYSIS OF THE APTITUDES AND INTERESTS OF ENLISTED MEN IN ELEVEN NAVAL AVIATION GROUPS, by Diane R. Albitz. Technical rept. no. 9 on Contract Nonr-710(17). Dec 58, 103p. 60 refs.
Order from LC mi$5.70, ph$16.80 PB 144 480

The present study carried out a complete discriminant analysis of the aptitudes and interests of enlisted men in eleven Naval aviation groups. Three questions were considered: 1) what are the distances that separate any two of the groups under study; 2) what are the directions in which these groups differ; and 3) can an individual known to be a member of one of these groups be assigned to that group. Thus, both the problem of testing significance and the problem of estimation were investigated. The results of this study indicate the usefulness of including measured interests with aptitude test scores in a discriminant analysis of occupational groups. The contribution of the interest scales in the linear discriminant scores used for classifying individuals into their group of cluster of membership provides evidence of the predictive validity of measured interests. Increased confidence in the utility of interest scales has been generated by the evidence this study presents for their predictive validity.

Quartermaster Research and Engineering Center, Natick, Mass.
SOUTHWEST ASIA: ENVIRONMENT AND ITS RELATIONSHIP TO MILITARY ACTIVITIES, by Austin Henschel. July 59, 85p. 9 refs. Technical rept. EP-118.
Order from LC mi$4.80, ph$13.80 PB 144 176

The environment of Southwest Asia, relationships between the environment and the soldier, and relationships between the environment and materiel are shown on maps and graphs. Most of the military problems of the region are caused by excessive heat and aridity, although the combination of heat and high humidity near the Persian Gulf and the Red Sea cause extreme discomfort at times in these particular areas. In much of the region, summer heat causes impairment of man's ability to work and increases his water requirements. The environment also causes storage and operating difficulties.

School of Aviation Medicine, Brooks AFB, Tex.
HUMAN EXPERIMENTATION IN THE SPACE CABIN SIMULATOR. DEVELOPMENT OF LIFE SUPPORT SYSTEMS AND RESULTS OF INITIAL SEVEN-DAY FLIGHTS, by George R. Steinkamp, Willard R. Hawkins and others. Aug 59, 89p. 5 refs. Rept. 59-101.
Order from LC mi$4.80, ph$13.80 PB 144 171

The evolvement of the simulator, as currently used, is described. The protocol of the design of the experiments is discussed, and pretesting and posttesting methods are presented. Results of a study of five subjects committed to 7-day periods in this small cabin and on a 4:4 work-rest schedule are shown and discussed from the standpoint of the physical, physiologic, psychophysiologic, and nutritional implications.

Tufts [U.] Medford, Mass.
A CHEMICAL AND PHYSIOLOGICAL STUDY OF THE GROWTH HORMONE OF THE ANTERIOR PITUITARY, by E. B. Astwood and M. S. Raben. Final rept for 1 May 52-31 July 58 on Contracts Nonr 789(00) and 1292(00). 22 Dec 58, 5p. 22 refs.
Order from LC mi$1.80, ph$1.80 PB 144 178

In summary, it might be stated that the work carried out on Growth Hormone under this contract has materially extended our knowledge of this important subject and has set the stage for extensive work, now being actively pursued in many laboratories, on the effects of growth hormone in man, work which heretofore was impossible and only now made feasible by the recognition of species differences, and by the availability of methods for the preparation of the primate hormone.

Biochemistry

Army Medical Research Lab., Fort Knox, Ky.
BLOOD COAGULATION: A CONCEPT OF THROMBIN FORMATION, by H. Jensen. Rept. on Environmental Physiology, Proj. 6-64-12-028. 22 Dec 58, 35p. 65 refs. Rept. no. 370.
Order from LC mi$3.00, ph$6.30 PB 144 032

A review of experimental data supports the concept of a four-stage mechanism of thrombin formation. The first stage involves the formation of a prothrombin activator from various precursory factors either by means of an intrinsic or an extrinsic mechanism or possibly by both. The second stage is the conversion of prothrombin to thrombin by the prothrombin activator in the presence of calcium ions. This represents the slow phase of thrombin elaboration. The third stage consists of the conversion of plasma accelerator-globulin by thrombin to the more active serum accelerator-globulin. The fourth stage of thrombin elaboration involves acceleration of prothrombin conversion by the prothrombin activator in the presence of serum accelerator-globulin and calcium ions; this represents the fast phase of thrombin elaboration. It is assumed that the final prothrombin-converting complex, thrombokinase, consists of a prothrombin activator and serum accelerator-globulin.

Columbia U., New York.
IMMUNOCHEMICAL CRITERIA OF PURITY OF PROTEINS AND POLYSACCHARIDES, by Elvin A. Kabat and Peter Z. Allen. Annual progress rept. for 1 Jan-31 Dec 58 on Contract Nonr-266(13).

5 Jan 59, 4p. 5 refs.
Order from LC mi$1.80, ph$1.80 PB 144 258

(See also PB 124 619)

Edinburgh U. (Gt. Brit.)
POST-OPERATIVE METABOLIC RESPONSE. Final technical rept. for 1 Oct 58-30 Sep 59 on Contract DA 91-591-EUC-920. [1959] 11p.
Order from LC mi$2.40, ph$3.30 PB 144 252

Animal experiments have been with the object of determining how far the changes in nitrogen, sodium and potassium excretion classically associated with injury are due to (a) purely local changes consisting of cell damage and/or presence of extravasated blood, (b) more general metabolic changes initiated by local damage. The picture emerging suggests that some of the sodium and potassium lost after trauma comes from extravasated blood, some comes from other tissues, and that oligaemia is an important factor. Continued work in human subjects suggests that the major metabolic changes following trauma can occur without alteration in the secretion of adrenal hormones, which are merely permissive. Further light on the movements of water (and electrolytes) after trauma will be given by studies of the excretion of "free" water. Preliminary survey work for this is now almost completed. As a by-product important observations have been made on the water, bicarbonate, sodium and potassium excretion in hyperparathyroidism and after administration of parathyroid hormone. Further work in this field may be expected to help in clarifying the mechanism of the parathyroid hormones.

New York Psychiatric Inst.
METABOLISM OF GLUTATHIONE, GLUTAMINE, AND ASPARAGINE, by Heinrich Waelsch. Annual progress rept. for 1 Jan-31 Dec 58 on Contract Nonr-369(00). 24 Dec 58, 4p. 7 refs.
Order from LC mi$1.80, ph$1.80 PB 144 232

(See also PB 125 642)

Oklahoma State U., Stillwater.
KINETICS AND MECHANISM OF HYDROLYSIS OF AMMONIUM CARBAMATE, by George Gorin. Technical note no. 3 on Studies on Urease, Contract AF 18(603)135. July 59, 13p. 7 refs. AFOSR-TN-59-775.
Order from LC mi$2.40, ph$3.30 PB 144 018

This note presents some results which were obtained in the course of a brief investigation of the rate of hydrolysis of ammonium carbamate in sodium hydroxide solution. The investigation was pursued only to a limited extent, and the results are not precise. Approximate rate constants have been determined for the hydrolysis of ammonium carbamate in 0.05, 0.10, and 0.25 M sodium hydroxide at 25°, and on the basis of these data, some conclusions regarding the mechanism have been drawn. In addition, some measurements have been made in dilute aqueous solution.

Pittsburgh U., Pa.
A STUDY OF THE MECHANISM OF PHOTOSENSITIZATION IN PHOTOSYNTHESIS, by Jerome L. Rosenberg. Annual progress rept. for 1 May-31 Dec 58 on Contract Nonr-624(08). 28 Jan 59, 3p.
Order from LC mi$1.80, ph$1.80 PB 144 236

School of Aviation Medicine, Randolph AFB, Tex.
SEASONAL VARIATION IN HUMAN AMINO ACID EXCRETION, by Henry B. Hale, James P. Ellis and Donald D. Van Fossan. June 59, 9p. 26 refs. Rept. 59-80.
Order from LC mi$1.80, ph$1.80 PB 144 218

Amino acid excretion was studied in young, healthy men during summer, fall, and winter months in a location in southwestern United States. Both random and timed urine samples were employed. The amino acids determined were alanine, arginine, cysteine, glutamic acid, glutamine, glycine, histidine, lysine, methyl histidine, serine, threonine, and valine. Supplemental determinations included urine volume, creatinine, uric acid, urea, sodium, and potassium. Using random samples, and expressing values as ratios with creatinine, significant seasonal variation was found for alanine, arginine, cysteine, glutamic acid, glycine, lysine, serine, urea, and uric acid. Although there was no significant variation in urine volume, both creatinine excretion and the urinary Na/K ratio varied significantly with season. These effects are interpreted as the result of changes in glomerular filtration and tubular reabsorption rates.

Washington U., Seattle.
ENZYMATIC DEGRADATION AND MODIFICATION OF PROTEOLYTIC ENZYMES, by Hans Neurath. Annual progress rept. for 1 Jan-31 Dec 58 on Contract Nonr-477(04). [1959] 4p. 3 refs.
Order from LC mi$1.80, ph$1.80 PB 144 231

The nature of the molecular changes accompanying the activation of trypsinogen and chymotrypsinogen has been investigated by chemical, physical and enzymatic methods. A study of the reaction of trypsin with diisopropylphosphofluoridate (DFP) with trypsin has been carried out in order to determine the nature of the peptide sequence involved in the combination between the enzyme and this organic phosphate. Kinetic and spectrophotometric measurements of the reaction between chymotrypsin and trypsin, respectively, and p-nitrophenylphosphate (NPA) and related compounds have suggested the formation of an acetyl-N-imidazole intermediate in the reaction of these proteolytic enzymes with acylating agents.

Medical Specialties and Equipment

Army Medical Research Lab., Fort Knox, Ky.
A CINEFLUOROGRAPHIC UNIT, by Lyle B. Deem, Olavi Weir and others. 5 Mar 58, 14p. 12 refs. Rept. no. 333; AD-153 647.
Order from LC mi$2.40, ph$3.30 PB 138 341

A unit for use in cinefluorographic studies is de-

scribed. Pulsed x-rays are obtained by the controlled firing of two thyratron tubes (placed in primary circuit of x-ray generator) by an electronic triggering circuit incorporated between camera and primary circuit. Synchronization between camera and triggering mechanism was required to obtain good quality cinefluorographs.

Ohio State U. Research Foundation, Columbus.
RESEARCH ON THE PRODUCTION OF CLINICAL RADIOGRAPHS BY MEANS OF COMPACT, LOW-ENERGY AND HIGH-INTENSITY RADIOACTIVE SOURCES, by H. D. Spangenberg and M. L. Pool. Technical rept. no. 1, 1 June-31 Dec 58, on Contract Nonr-495(17). Jan 59, 37p.
Order from LC mi$3.00, ph$6.30 PB 144 198

On the evaluation of the properties characteristic to various possible radioactive sources that may be suitable for clinical dental radiography. Two parallel and independent approaches are made to improve the sensitivity of radiation measurements. One is the slow but gradual increase in photographic film sensitivity and the other is the new and promising light amplifiers. Many sources that cannot be made sufficiently intense for film work may be very satisfactory if light amplifiers become perfected.

School of Aviation Medicine, Randolph AFB, Tex.
THE EFFECTIVENESS OF A TOPICAL APPLICATION OF STANNOUS FLUORIDE IN A PREVENTIVE DENTISTRY PROGRAM: A REVIEW OF THE LITERATURE, by Norman O. Harris and Warren R. Hester. Sep 58, 19p. 72 refs. Aeromedical Reviews 2-59; AD-205 618.
Order from LC mi$2.40, ph$3.30 PB 138 432

Contents:
Requirements for a successful preventive dentistry program
Efforts of research to reduce caries incidence
Therapeutic effect of sodium fluoride mouthwashes, troches, and pastes
Beneficial effects of fluoridation of communal water supplies
Effects following topical application of sodium fluoride to teeth of juveniles and adults
Effectiveness of stannous fluoride in laboratory experimentation
Reduction of carious lesions following use of stannous fluoride toothpastes
Superiority of topically applied stannous fluoride over sodium fluoride in reducing caries among children
Effectiveness of topical applications of stannous fluoride in reducing caries in adults
Method of topical application of stannous fluoride
Possible contraindications for the use of topically applied stannous fluoride

Pathology

Army Chemical Warfare Labs., Army Chemical Center, Md.
AIR BLAST STUDIES WITH ANIMALS, by R. S. Anderson, Fred W. Stemler and others. July 59, 23p. 6 refs. CWLR-2288; AFSWP-1110.
Order from LC mi$2.70, ph$4.80 PB 144 036

Goats, rabbits, and mice have been exposed to air blasts in a shock tube. Translation seemed to be the major cause of injury except for damage in the ears. Correlations have been made between the air pressure, velocity, and distance traversed by the animals.

Army Chemical Warfare Labs., Army Chemical Center, Md.
A COMPARISON OF THE BURN-PRODUCING EFFECTIVENESS OF TWO INCENDIARY AGENTS, 4.2% M1 AND 4% E10, by Matthew J. Wargovich. Aug 59, 40p. 3 refs. CWLR 2298; AD-225 614.
Order from LC mi$3.00, ph$6.30 PB 143 913

The burn-producing effectiveness of two incendiary agents, 4.2% M1 and 4% E10, was tested on rabbits using the triple response as a criterion for determining the extent of skin damage produced by fires lasting from 5 to 60 seconds (in 5-second intervals). All burns were classified as subthreshold, threshold, or suprathreshold, depending on the responses elicited. All burns were defined microscopically as well as grossly. Rabbit tissue burned with 4% E10 took from 2 to 8 days longer to heal than did tissue burned with 4.2% M1 under similar conditions. Per given volume and burning time, 4% E10 produces a larger and deeper burn than 4.2% M1 under similar conditions.

Connecticut Coll., New London.
A COMPARISON OF DISCRIMINATION THRESHOLDS FOR BRIGHTNESS AND SATURATION IN DEUTERANOPIC, DEUTERANOMALOUS, AND NORMAL OBSERVERS, by Jane W. Torrey. Final project rept. on Evaluation of Color Vision Test, Contract Nonr-996(03). Dec 58, 38p. 9 refs.
Order from LC mi$3.00, ph$6.30 PB 144 181

Chromaticity discrimination was measured along two dimensions on the I. C. I Diagram, both passing through the neutral center of the diagram so that differences on either side of the center were differences of saturation. One line approximated the dimension of maximum confusion for deutans, bluish red and bluish green; the other was nearly perpendicular to it and should represent minimum confusion, blue and yellow. The more severe the color defect, the higher were the discrimination thresholds. The trend was most striking on the red-green dimension, where it was fully expected. On blue-yellow and brightness discrimination the differences according to degree of color defect were not as clear but it seemed possible from these results that they may exist. Tests of reliability of the measurements from day to day indicate that there are uncontrolled sources of variability in the apparatus which are too large to permit any more exact calibration of the system of classifying color defect. While the differences between sessions were not enough to vitiate entirely the differences between observers, it is clear that the next step in this research would have to be a redesigning of the apparatus to permit more consistent measurements.

School of Aviation Medicine [Brooks] AFB, Tex.
AN INTRODUCTION TO THE STOCHASTIC THEORY OF EPIDEMICS AND SOME RELATED STATISTICAL PROBLEMS, by A. T. Bharucha-Reid (Columbia U.). Dec 57, 31p. 55 refs. Rept. 58-40; AD-153 786.
Order from LC mi$4.80, ph$13.80 PB 144 172

In this monograph an attempt is made to give an account of the stochastic theory of epidemics and related statistical problems that will be useful to the epidemiologist, medical statistician, and applied probability theorist who may be interested in problems of this nature. Chapters I and II are intended to serve as an introduction to the theory of discrete and continuous branching stochastic processes. In Chapter II a review and discussion of stochastic models in epidemic theory is presented. In Chapters IV and V some statistical problems associated with branching stochastic processes, and their applications to epidemic situations are considered.

Wallace, A. B.
STUDIES IN THE POST TRAUMATIC PATIENT: SODIUM BALANCE STUDIES, NITROGEN UTILISATION, FAT ABSORPTION, ASCORBIC ACID REQUIREMENT, by Anne B. Sutherland, Christine G. Colver and others. Annual technical status rept. for 1 Sep 58-31 Aug 59 on Contract DA 91-508-EUC-354. 1 Sep 59, 82p.
Order from LC mi$4.80, ph$13.80 PB 144 180

The studies detailed in this report have been performed on patients admitted to Plastic Surgery Service. With one exception, the patients have been under the age of twelve years, and all patients had sustained moderate to severe burning injury. Techniques have been adapted, or improved, in the light of experience. A broad picture emerges of the response of children to this type of injury.

Pharmacology and Toxicology

Army Chemical Warfare Labs., Army Chemical Center.
AN ESTIMATION OF THE PER CENT MILITARY EFFECTIVENESS OF SOLDIERS WITH VARIOUS DEGREES OF INCAPACITATION FROM GB VAPOR IN VARIOUS TACTICAL SITUATIONS, by Charles H. Trask, Milton K. Christenson and others. Aug 59, 11p. 7 refs. Technical rept. CWLR-2294; AD-225 136.
Order from LC mi$2.40, ph$3.30 PB 144 033

Estimates of the frequency of poisoning by various Ct exposures to GB vapor in men are presented for mild, moderate, severe, very severe, and lethal effects. The per cent military effectiveness in four tactical situations is estimated for soldiers with these degrees of poisoning.

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE INFLUENCE OF BODY WEIGHT ON INHALATION TOXICITY OF GB VAPOR TO DOGS EXPOSED FOR TWO MINUTES, by William S. Koon, Francis P. McGrath, and Fred W. Oberst. Rept. for 24 Sep 53-7 Dec 54 on Toxicology of CW Agent Vapor. Oct 58, 14p. 13 refs. CWLR 2247.
Order from LC mi$2.40, ph$3.30 PB 144 169

No significant differences in LC50 of GB vapor or in times to incapacitation were found between three different weight groups of dogs, where t = 2 minutes. However, a significant difference was noted between the death times of the large and small dogs. The medium-sized dogs exhibited a mean death time which could not be shown to differ significantly from those of either the large or small dogs.

Medical Coll. of Virginia, Richmond.
GASOMETRIC DETERMINATIONS OF HYDRAZINO COMPOUNDS, by Herbert McKennis and Allen Yard. Rept. on Contract DA 18-108-cml-5750. Nov 57, 16p. 18 refs. CWL Special pub. 2-4.
Order from LC mi$2.40, ph$3.30 PB 143 914

Previous reports contain discussion of the nature of the reaction of iodate with hydrazine compounds, and the use of this reaction in investigating the biological effects of hydrazine compounds. In keeping with the increase in emphasis on the study of other materials not related to hydrazine the work on the gasometric determination of hydrazine compounds has been concluded. This report summarizes the results and discusses the general principles which have been delineated.

School of Aviation Medicine, Brooks AFB, Tex.
PAROTID FLUID, SERUM, AND URINE 17-HYDROXYCORTICOSTEROIDS FOLLOWING THE INTRAMUSCULAR ADMINISTRATION OF REPOSITORY CORTICOTROPIN, by Ira L. Shannon, John R. Prigmore and others. Aug 59, 4p. 11 refs. Rept. 59-92.
Order from LC mi$1.80, ph$1.80 PB 144 173

In healthy young adult males, the intramuscular administration of 40 I.U. of corticotropin produced the expected alterations in serum and urine 17-hydroxycorticosteroids. The parotid steroid pattern very closely paralleled that of the serum. The results of the present study strengthen the premise that free 17-OHCS levels in parotid fluid may well be utilized in evaluating adrenocortical status. The use of this method makes possible continuous sampling of a completely nonstressful nature, and, even in extremely close quarters where blood sampling is impossible, the subject can be easily taught to carry out the sampling procedure upon himself.

Sterling Labs., Arlington, Va.
DIPROPARGYL ETHER: ORAL LD_{50} - MALE RATS; PRIMARY SKIN IRRITATION - RABBITS; EYE IRRITATION - RABBITS. 1.6 HEPTADIYNE: PRIMARY SKIN IRRITATION - RABBITS; EYE IRRITATION - RABBITS. Rept. on Contract Nonr-2727(00). [1958] 12p.
Order from LC mi$2.40, ph$3.30 PB 144 271

Report consists of tabulated results.

Radiobiology

Army Medical Research Lab., Fort Knox, Ky.
THE PROPHYLACTIC INFLUENCE OF CYSTEINE ON THE SPLEEN OF RATS EXPOSED TO WHOLE BODY X-IRRADIATION, by W. H. Parr, T. A. O'Neill, and R. Korson. 23 Jan 58, 23p. 22 refs. Rept. no. 281; AD-151 366.
Order from LC mi$2.70, ph$4.80 PB 138 332

A sequential comparative study of spleen weights was made from rats exposed to 600 r, 720 r, 880 r, and 720 r pretreated with cysteine. In the group pretreated with cysteine, the results suggested a possibility of cysteine-influenced protective action. However, statistically significant differences between the spleen weights of the 720 groups were found only on the 3rd, 6th, and 8th days. Histological studies of these spleens (720 r and 720 r pretreated with cysteine) also show little differences in cellular response.

Michael Reese Hospital of Chicago, Ill.
STUDY OF SOME PHYSICAL AND BIOLOGICAL ASPECTS OF THE ACTION OF HIGH ENERGY ELECTRONS ON MICROORGANISMS, by E. M. Uhlmann and J. Ovadia. Rept. no. 2 (Final) 29 Mar 57-31 Jan 58, on Contract DA 19-129-qm-916. [1958] 74p. 37 refs. QFCIAF File no. S-565.
Order from LC mi$4.50, ph$12.30 PB 143 835

Various factors affecting dose distributions produced by 25 Mev electrons in unit density material have been investigated and are discussed. Depth dose curves for a 10 x 10 cm beam at energies varying from 10 to 40 Mev are presented. The variation of penetration of 25 Mev electrons for different beam sizes is also reported. Satisfactory methods of obtaining a uniform distribution throughout a volume 8 inches thick are described. Serious difficulties in adequately monitoring an electron beam scanning a food package after the large magnetic deflection required to irradiate it from opposite side are discussed in the light of experience obtained with the accelerator at this installation. The health hazards at the irradiation site arising chiefly from the 20 minute Carbon 11 activity was calculated for assumed irradiation schedules. The health hazard arising from ingestion of radioactive food is also calculated and discussed. Only preliminary phases of the biological program were completed. Experience in synchronization of bacterial cells is discussed.

School of Aviation Medicine, Randolph AFB, Tex.
OBSERVATION OF LATENT EFFECTS FOLLOWING TOTAL-BODY GAMMA RADIATION IN THE BURRO, by U. S. G. Kuhn, III, Roy E. Kyner and others. June 59, 9p. 2 refs. Rept. 59-76.
Order from LC mi$1.80, ph$1.80 PB 144 465

The results of continued observation of burro survivors of sublethal doses of total-body gamma-ray irradiation are reported. Five deaths occurred during the observation period of this project, 3.6 years from November 1954 to May 1958. In four decedents cause of death was associated with irradiation experience. The survivors seemed to make an early clinical and hematologic recovery and now appear to enjoy normal health and condition. Within two years after irradiation blood elements and weights were observed to be within values exhibited by nonirradiated controls.

CHEMISTRY

Army Engineer Research and Development Labs., Fort Belvoir, Va.
HYDRAZOIC ACID AND THE METAL AZIDES (A LITERATURE SURVEY), by Hyman Rosenwasser. 28 Oct 58, 77p. 437 refs. Rept. 1551-TR; AD-208 892.
Order from LC mi$4.50, ph$12.30 PB 144 106

This report covers a literature survey of unclassified literature published since 1934 on HN_3 and the metal azides. The report is divided into 9 chapters: Hydrazoic acid; Alkali metal azides; Emission and absorption of ultraviolet radiation; Ammonium azide and the alkaline earth azides; Lead azides; Silver, thallium, and gold azides; Copper azides and complex azide compounds; Azides of Be, Mg, B, Al, Ga, Si, P, and Cd; and Thermochemistry and microchemistry.

Purdue Research Foundation, Lafayette, Ind.
SYMPOSIUM ON THE CHEMISTRY OF THE LESS FAMILIAR ELEMENTS, by James W. Cobble. Final rept. on Contract AF 49(638)233. Aug 59, 44p. 1 ref. AFOSR-TR-59-101; AD-226 190.
Order from LC mi$3.30, ph$7.80 PB 143 887

On April 14 - 16, the Air Force Office of Scientific Research and the American Chemical Society Division of Inorganic Chemistry held a joint symposium on the "Chemistry of the Less Familiar Elements at the National American Chemical Society Meeting in San Francisco, California. Twenty-nine papers, including those by eight foreign speakers from five countries were presented. This report includes a program, list of speakers, list of foreign participants, and copies of the abstracts of the papers. Titles of the papers follow Recent advances in inorganic chemistry and metallurgy of the rare earth elements; The properties of the actinide metals; Absorption and fluorescence spectra of actinide elements; Absorption spectra of actinide compounds in solution; Thermodynamic and kinetic properties of some rare earth oxide-oxygen systems; Hydrocarbon derivatives of the transition metals; Advances in aromatic-metal compounds; Recent advances in organo-metallic chemistry; Light scattering studies on aqueous gallium perchlorate solutions; The polymerization of chromic ion in aqueous solution; Hydrolytic polymerization of metal alkoxides, Equilibrium ultracentrifugations of hydrolytic polymers; On the formation of polynuclear complexes in aqueous solutions; The phosphinic nitrides - a family of inorganic polymers; Preparation of metastable and low-stability inorganic solids by high temperature techniques; Chemical reactions of free radicals at low temperature; Application of the floating zone technique for growing GaAs single crystals; Recent developments in the alkali metal hydride synthesis of diborane and borohydrides, Synthesis and reactions

of organo-boron halides and oxides; The preparation and properties of some binary borides; The ammonia addition compounds of diborane and tetraborane.

Diboron tetrachloride; Bonding problems in the molecular addition compounds of boron; Addition compounds formed by the trihalides of boron and gallium. The determination of the formulas of aqueous ruthenium (III) species by means of ion exchange resin: Ru^{+3}, $RuCl^{+2}$ and $RuCl_2^{+}$. The chlorides of niobium and tantalum. Results of the last ten years; Spectrophotometric examination of certain oxidation states of rhenium and technetium; Acceptor pi-bonding in transition metal compounds; The nature of Ru(IV) in dilute perchloric acid.

Analytical Chemistry

Belcher, R.
SUBMICRO METHODS FOR THE ANALYSIS OF ORGANIC COMPOUNDS: DETERMINATION OF CHLORINE AND HYDROGEN. Annual technical rept. for 1 Oct 58-30 Sep 59 on Contract DA 91-591-EUC-902. 30 Oct 59, 15p. 17 refs.
Order from LC mi$2.40, ph$3.30 PB 144 470

The main objective of this programme is to provide a complete system of analysis for organic compounds in the submicro-scale. There remained two common organic elements (chlorine and hydrogen) for which methods had to be developed.

Ledoux and Co., Teaneck, N. J.
ION EXCHANGE AND OTHER CHEMICAL METHODS FOR BERYLLIUM BASE ALLOYS, by Silve Kallman, Robert Liu, and Hans Oberthin. Rept. for May 58-May 59 on Contract AF 33(616)5743. Sep 59, 41p. 6 refs. WADC Technical rept. 59-325.
Order from OTS $1.25 PB 161 295

While individual elements in association with beryllium can be determined by conventional chemical methods, ion exchange procedures are extremely useful when beryllium is combined with a number of alloying constituents. Procedures are described in this report involving both cation and anion exchange resins which allow the determination of all elements in successive steps using one sample portion. The elements covered in the range of 0.1 to 10% are copper, aluminum, iron, nickel, cobalt, cerium, silver, gold and palladium.

Naval Ordnance Test Station, China Lake, Calif.
A THERMISTORIZED APPARATUS FOR DIFFERENTIAL THERMAL ANALYSIS, by Jack M. Pakulak, Jr. and Guy William Leonard. 19 June 58, 20p. 4 refs. NOTS 1920; NAVORD rept. 5829; AD-203 260.
Order from LC mi$2.40, ph$3.30 PB 144 157

The application of differential thermal analysis for the study of organic compounds is becoming increasingly important. Since the characteristic portions of the thermograms for most organic compounds lie in the 20 - 300°C range, a simple and very sensitive apparatus, using thermistors in place of thermocouples, is described which has proved to be reliable and accurate in the temperature range covered. The applicability of this apparatus is shown by the determination of thermograms for certain inorganic and organic compounds.

Organic Chemistry

California U., Los Angeles.
MOLECULAR ORBITAL STUDY OF IONIZATION POTENTIALS OF ORGANIC COMPOUNDS, by Andrew Streitwieser, Jr. Rept. on Contract AF 49(638)1212. 27 Aug 59, 109p. 123 refs. AFOSR [TN] 59-893, 59-(912-915).
Order from LC mi$5.70, ph$16.80 PB 144 168

Contents:
Part I. Radicals and Non-Alternant Hydrocarbons, AFOSR-TN-59-893
Part II. Methyl Compounds, AFOSR-TN-59-912
Part III. Saturated Hydrocarbons, AFOSR-TN-59-913
Part IV. Acetylenes and Allenes, AFOSR-TN-59-914
Part V. Chlorine, Oxygen and Nitrogen Compounds, AFOSR-TN-59-915

Diamond Ordnance Fuze Labs., Washington, D.C.
HEAT OF POLYMERIZATION OF PHENYL GLYCIDYL ETHER AND OF AN EPOXY RESIN, by C. H. Klute and W. Viehmann. 28 Aug 59, 33p. 12 refs. TR-758; AD-226 590.
Order from LC mi$3.00, ph$6.30 PB 143 948

A differential thermal analysis apparatus was designed and constructed for the accurate measurement of heats of polymerization. With this apparatus the mean value for three determinations of the heats of polymerization of epoxy resins or of phenyl glycidyl ether could be measured to within a standard error of 0.37 kcal per mole. Primary amine curing agents released about 26 kcal per mole, tertiary amines and boron trifluoride-ether complex each released about 22 kcal per mole and mixed type curing agents which could react in part as tertiary amines and in part as primary amines released intermediate amounts of heat.

North Dakota U. [Grand Forks].
ORGANOMETALLIC COMPOUNDS OF TRANSITION METALS, by Lawrence Summers, David C. Hampton, and David Y. L. Liu. Technical rept. no. 6 (Final), 1 June 57-31 Mar 58, on Contract Nonr-582(00). 30 Jan 59, 22p.
Order from LC mi$2.70, ph$4.80 PB 144 141

The last previous report described the continuation of investigations on bis(cyclopentadienyl) compounds of titanium, and the extension of this investigation to zirconium and chromium compounds. Of the transition metals of the 3d series, the remaining one of interest was vanadium. Studies were made of reactions of vanadium chlorides with active cyclopentadienyl-metal derivatives.

Queen's U., Belfast (North Ireland)
MECHANISMS OF THE OXIDATION OF ORGANIC AMINES BY OXYGEN AND BY FREE RADICAL OXIDIZING AGENTS, by H. B. Henbest. Annual technical rept. for 5 July-30 Sep 59 on Contract DA 91-508-EUC-389. [1959] 46p. 25 refs.
Order from LC mi$3.30, ph$7.80 PB 144 250

Covers the following subjects: Oxidation of Amines with Oxygen, Oxidation of Amines with Alkoxyl Radicals, Reactions of Amines in Aqueous Solution with Oxidants undergoing One-Electron Transfer.

Texas U., Austin.
DECOMPOSITION OF VINYLACETYLENE AND DIACETYLENE AND THEIR INTERACTION WITH ACETYLENE, by J. D. Frazee and R. C. Anderson. Technical note 6 on Contract AF 18(603)142. Aug 59, 44p. 26 refs. AFOSR-TN-59-934.
Order from LC mi$3.30, ph$7.80 PB 144 384

Vinylacetylene and diacetylene are possible intermediates in the thermal decomposition of acetylene. The present experiments were, therefore, undertaken to study the decomposition of these and their interaction with other gases such as acetylene or hydrogen. The reactions were studied in a flow system at temperatures of 400-900°, using vapor-liquid chromatography to analyze the gaseous products. Reaction is rapid enough so that experiments were limited to mixtures containing 20% or less or the reagent in an inert diluent.

Physical Chemistry

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
THE EFFECTS OF ELECTRODE CONTAMINATION ON THE PROPERTIES OF AIR-ARC PLASMAS, by Harold Y. Wachman, Milton J. Linevsky and John H. McGinn. Rept. on [Contract AF 04(647)269]. 21 Sep 59, 26p. 11 refs. Technical Information Series R59SD427.
Order from LC mi$2.70, ph$4.80 PB 144 133

The plasma test environments originating from arcs are usually contaminated with material from the arc electrodes. Carbon electrodes contribute appreciable quantities of vapor which alter the chemical composition and thermodynamic properties of the jet and cooled copper electrodes contribute trace quantities of vapor which, as expected, alter the character of the electrical discharge. In this work, the chemical composition and thermodynamic properties of air are compared to those of air-carbon gaseous mixtures containing 1-30% carbon by weight. The comparison of the different environments is made over the temperature range 4000-10,000°K and pressures between 0.1 and 100 atmospheres. The effects of trace amounts of copper on the electrical conductivity and power dissipated in the air arc column are calculated.

Antioch Coll., Yellow Springs, Ohio.
PHYSICAL CHEMISTRY OF AQUEOUS SOLUTIONS, by James F. Corwin. Quarterly rept. no. 1, 1 Mar - 31 May 57, on Research on Aqueous Solutions at or above Critical Temperature of Water, Contract DA 36-039-sc-73211. [1957] 83p. 48 refs. AD-139 823
Order from LC mi$4.80, ph$13.80 PB 138 089

Contents:
Factual data on conductivity of solutions above the critical temperature; reaction of alkaline earth metal compounds with silica; program for studying the effect of fluoride ion on the hydrothermal formation of quartz; studies of the hydrothermal reactions of germanium dioxide; geological and crystallographic investigations
Hydrothermal reactions under supercritical conditions. IV. The reaction between strontium hydroxide and silica
Hydrothermal reactions under supercritical conditions. III. The effect of pH on the crystallization of silicon
Data on some crystalline compounds in the system Na_2O-GeO_2-H_2O

Antioch Coll., Yellow Springs, Ohio.
PHYSICAL CHEMISTRY OF AQUEOUS SOLUTIONS, by James F. Corwin. Quarterly rept. no. 2, 1 June - 31 Aug 57, on Research on Aqueous Solutions at or above the Critical Temperature of Water, Contract DA 36-039-sc-73211. [1957] 41p. 19 refs. AD-146 491.
Order from LC mi$3.30, ph$7.80 PB 138 090

Contents:
Factual data on conductivity of solutions above the critical temperature; reactions of alkaline earth metal compounds with silica; hydrothermal reactions of germanium dioxide; geological and crystallographic investigations
Germanium chalcedony
A proposal for the hydrothermal study of the alumina-water system.
(See also PB 138 089)

Antioch Coll., Yellow Springs, Ohio.
PHYSICAL CHEMISTRY OF AQUEOUS SOLUTIONS, by James F. Corwin. Quarterly rept. no. 3, 1 Sep-30 Nov 57, on Research on Aqueous Solutions at or above the Critical Temperature of Water, Contract DA 36-039-sc-73211. [1957] 39p. 23 refs.
Order from LC mi$3.00, ph$6.30 PB 138 088

Contents:
Factual data on conductivity of solutions above the critical temperature; reactions of alkaline earth metal compounds with silica; hydrothermal reactions of Al_2O_3; hydrothermal reactions of germanium dioxide; geological and crystallographic investigations
Hydrothermal reactions in the Na_2O-GeO_2 system
(See also PB 138 090)

Antioch Coll., Yellow Springs, Ohio.
PHYSICAL CHEMISTRY OF AQUEOUS SOLUTIONS, by James F. Corwin. Quarterly rept. no. 4, 1 Nov 57-28 Feb 58, on Research on Aqueous Solutions at or above the Critical Temperature of Water, Contract DA 36-039-sc-73211. [1958] 39p. 12 refs.
Order from LC mi$3.00, ph$6.30 PB 138 091

Contents:
Factual data on conductivity of solutions above the critical temperature; hydrothermal studies on aluminum oxides; geological and crystallographic investigations
Hydrothermal reactions under supercritical conditions. V. Reactions between silica and alkaline earth metal salts
Sodium tetragermanate, $Na_2Ge_4O_9$, tetragonal form
Report on durability of AC spark plugs no. 448 JKD Part no. 062157 and no. 062157-1
(See also PB 138 088)

Atlantic Research Corp., Alexandria, Va.
FLAME STABILIZATION, by Arch C. Scurlock and John H. Grover. Rept. on Contract Nonr-1858(25). Jan 59, 62p. 8 refs. Proj. Squid Technical rept. ARC-5-R; AD-226 180.
Order from LC mi$3.90, ph$10.80 PB 144 332

An investigation was made of the mechanism of flame stabilization behind bluff bodies in high-velocity gas streams. Blow-off velocity data were obtained by using (1) rod-shaped flameholders in a rectangular combustion chamber which, in effect, produced a 2-dimensional flame, and (2) spherical flameholders in a circular chamber which produced a 3-dimensional flame. The fuels used were natural gas, propane, and hydrogen. The results showed that such variables as the molecular diffusivity of the fuel, flow Reynolds number, and laminar flame velocity and quenching distance of the gas had a large effect on stability. Two-dimensional stabilizer (rods) had better stability than did 3-dimensional stabilizers (spheres) of the same characteristic dimension. However, neither the rod nor sphere data were completely free of the influence of the apparatus. Hydrogen had the best stability of the 3 fuels studied; propane had better stability than natural gas (88% methane). Measurements of pressure distribution in the chamber indicated that the presence of the flame greatly alters the flow pattern in the vicinity of the flame.

California U., Berkeley.
THE PERTURBATION OF MOLECULAR DISTRIBUTION FUNCTIONS BY CHEMICAL REACTION, by Bruce H. Mahan. Rept. on Contract AF 49(638)01. 21 Sep 59, 12p. 9 refs. AFOSR-TN-59-990.
Order from LC mi$2.40, ph$3.30 PB 144 017

A collision cross-section for radial combination reactions is derived which indicates that translationally hot free radicals combine faster than the average thermal radicals. The cross-section is used to calculate the disturbance of the equilibrium distribution of velocities by radical combination reactions. It is concluded that the equilibrium assumption of chemical kinetics is justified for photochemical systems where the radical concentrations are low, but may be violated in systems where free radical concentrations approach 0.1 mole fraction.

California U., Berkeley.
SPECTROSCOPIC STUDY OF THE PHOTOLYSIS OF DIAZOMETHANE IN SOLID NITROGEN, by Theodore D. Goldfarb and George C. Pimentel. Rept. on Contract AF 49(638)01. 25 Sep 59, 13p. 7 refs. AFOSR-TN-59-991.
Order from LC mi$2.40, ph$3.30 PB 144 016

Diazomethane or partially deuterated diazomethane was suspended in solid nitrogen at 20° K and photolyzed with filtered light and a spectroscopic study was extended from the ultraviolet (2300 A) through the infrared (to 650 cm^{-1}). An unstable substance is stored which produces ethylene after diffusion is permitted. This ethylene precursor is lost, as are visible-ultraviolet absorptions at 4182, 3968, and 3050-3300 A, when the photolyzing radiation includes only wavelengths longer than 3400 A. Absorption at 2620 A was detected only in experiments at high concentrations (low M/R), making it extremely unlikely that this absorption is caused by CH_2. Finally, an absorption at 2470 A not caused by diazomethane was present before photolysis. This could be the tautomeric compound, isodiazomethane.

[Chicago U., Ill.].
REVIEW OF WORK. Final rept. on Contract N6ori-02026. [1958] 12p. 23 refs.
Order from LC mi$2.40, ph$3.30 PB 144 444

The final report will take the form of a review of the principal results of the research done under contract. The work can conveniently be discussed under three general subject headings: (1) Mechanisms of Redox Reactions (2) Constitution of Complex Ions (3) Mechanisms of Substitution Reactions of Complex Ions. Research done under the contract and published in the chemical literature is cited in footnotes; related work, not done under the contract but relevant to this review, is cited in the body of the report. Not all the papers published under contract auspices are included in the references.

Cornell U., Ithaca, N. Y.
A STUDY OF EVAPORATED ALUMINUM FILMS BY X-RAY TOTAL REFLECTION, by R. C. Duncan and L. G. Parratt. Technical rept. no. 13 on Contract AF 18(600)300. 21 Aug 58, 108p. 45 refs. AFOSR-TN-58-680; AD-162 212.
Order from LC mi$5.70, ph$16.80 PB 137 433

Films freshly deposited, then heat treated in successive steps up to 400°C or anodized in successive steps up to an oxide thickness of about 625A, have been studied. The theory of reflection based on homogeneous media accounts reasonably satisfactorily for the shape of the reflection curves near the critical angle for total reflection, but it seems necessary for the heat treated and anodized films to introduce a surface model which contains inhomogeneities in order to account for the shapes of the curves at smaller glancing angles.

Florida U. Engineering and Industrial Experiment Station, Gainesville.
FLUOROCARBON N-F COMPOUNDS, by J. A. Young and R. D. Dresdner. Quarterly technical rept. no. 1, 1 Aug-30 Sep 59, on Contract DA 01-009-ORD-772. [1959] 13p.
Order from LC mi$2.40, ph$3.30 PB 144 131

Fluorocarbon NF compounds have been made by three methods: addition of fluorine across C-N unsaturation, fluorination of NH groups, and replacement of acyl groups on nitrogen by fluorine. Formation of the NF group is competitive with N-N coupling or with rearrangement of the free radical first formed. The following group reactions have been found: $R_FCN \longrightarrow R_FCF_2N{=}NCF_2R_F$, $(R_F)_2NH \longrightarrow (R_F)_2NF + (R_F)_2N\text{-}N(R_F)_2$, $(R_F)_2NCOF \longrightarrow (R_F)_2NF + (R_F)_2N\text{-}N(R_F)_2$, $R_FCONH_2 \longrightarrow R_FNCO$, $R_FNCO \longrightarrow R_FN{=}NR_F$, and $R_FNHCOF \longrightarrow (R_FNCOF)_2$. Present production of NF_3 is by the electrochemical method using pyridine in anhydrous HF. The by-products are C_5F_{12} and cyclo-$C_5F_{10}NF$.

Frick Chemical Lab., Princeton U., N. J.
A GENERAL TREATMENT OF EQUILIBRIUM POLYMERIZATION, by A. V. Tobolsky and A. Eisenberg [Technical rept. on Research in High Polymer Chemistry Rates of Initiation in Vinyl Polymerization, Contract DA 36-034-ORD-2190]. [1959] 19p. 12 refs.
Order from LC mi$2.40, ph$3.30 PB 144 389

A general theory of equilibrium polymerization is presented. Three chemical categories are discussed: equilibrium polymerization in the presence of an initiator, e.g., caprolactam, and two categories that do not involve an initiator, represented by sulfur and by vinyl monomers, respectively. Two mathematical approximations are considered. In certain cases the chemical facts and the experimental results allow a treatment based on a single equilibrium constant. In very many cases, however, a two constant treatment is necessary, e.g., caprolactam initiated by water and the polymerization of sulfur. It is suggested that a two constant treatment is also necessary for describing the equilibrium polymerization of vinyl monomers.

Frick Chemical Lab., Princeton U., N. J.
THE THERMAL OZONE-HYDROGEN REACTION, by Theodore P. Williams and David Garvin. Technical note no. 6 on Contract AF 18(603)134. 15 Sep 59, 36p. 18 refs. AFOSR-TN-59-979.
Order from LC mi$3.00, ph$6.30 PB 144 019

The kinetics of the reaction between dilute ozone and molecular hydrogen has been studied in the temperature range 400-500° K using a flow technique. Water is the principal product, small amounts of hydrogen peroxide also are formed. The reaction competes with the thermal decomposition of ozone. It is concluded that the oxidation of hydrogen is initiated by oxygen atoms formed in the thermal decomposition of ozone, and that a short chain sequence occurs. Mechanisms involving either OH or both OH and HO_2 are presented.

General Electric Co., Schenectady, N. Y.
VARIOUS ACTIVATOR-REFRACTORY SUBSTRATE COMBINATIONS, INVESTIGATION OF, by J. H. Affleck. Scientific rept. no. 5 on Contract AF 19(604)4093. 22 Sep 59, 15p. 2 refs. AFCRC-TN-59-757.
Order from LC mi$2.40, ph$3.30 PB 144 187

Thermionic properties of cesium on various refractory materials. Dispenser cathodes have been fabricated using a barium activator. (See also PB 142 346)

Grinnell Coll., Iowa.
CRACKING REACTIONS CATALYZED BY THE SILICA-ALUMINA CRACKING CATALYST, by Joseph D. Danforth. Final rept. for 1948-1957 on Contract N8onr-67100. [1957] 5p. 8 refs.
AD-142 932.
Order from LC mi$1.80, ph$1.80 PB 137 704

Harvard U., Cambridge, Mass.
THE MICROWAVE SPECTRUM, BARRIER TO INTERNAL ROTATION, AND STRUCTURE OF METHYL FORMATE, by R. F. Curl, Jr. Rept. on Contract N5ori-1866(14). [1958] 25p. 19 refs.
Order from LC mi$2.70, ph$4.80 PB 143 935

Rotational constants have been assigned to the following isotopic species of methyl formate by investigation of their microwave spectra: $HCOOCH_3$, $DCOOCH_3$, $HCOOCH_2D$, $HCOOCD_3$, $HC^{13}OOCH_3$, $HCOOC^{13}H_3$, $HCO^{18}OCH_3$, and $HCOO^{18}CH_3$. Structural parameters were obtained from these rotational constants. The barrier to internal rotation of the methyl group was calculated from the splittings observed in the rotational transitions of the ground torsional state for several isotopic species. The dipole moment was calculated from the observed Stark effect.

Illinois Inst. of Tech., Chicago.
KINETICS AND MECHANISMS IN IONIC MELTS, by A. G. Kennan. Final rept. for 1 Sep 54-1 Sep 57 on Contract AF 18(600)1148. [1957] 13p. 15 refs.
AFOSR TR-57-48; AD-132 478.
Order from LC mi$2.40, ph$3.30 PB 138 490

A spectrophotometric investigation was made of fused NH_4NO_3 with UV spectra. Several successful spectra were obtained for pure fused NH_4NO_3 in repeated trials; the best spectra were measured at 175°. The sample thickness was about 0.2 mm. The data show the manner in which the resolution deteriorated in other samples, and the way in which the total absorbance was decreased where the mounting was less successful. The film was shown to be heterogeneous because of bubbles. The addition of HNO_3 to NH_4NO_3 did not improve the spectra. The data substantiated the conclusion from cryoscopic data that pure fused NH_4NO_3 is a simple ionic system when approaching its melting point.

Instituto de Quimica Fisica (Spain).
KINETICS AND MECHANISMS OF THE THERMAL DECOMPOSITION OF ACETALS, by M. J. Molera, J. Morcillo and others. Annual technical rept. no. 1, 1 Sep 58-31 Aug 59, on Contract DA 91-508-EUC-360, [1959] 65p. 34 refs.
Order from LC mi$3.90, ph$10.80 PB 144 239

As a contribution to basic research on the kinetics of thermal decomposition of organic compounds, four acetals have been selected for study:

formaldehyde dimethyl acetal
formaldehyde diethyl acetal
acetaldehyde dimethyl acetal
acetaldehyde diethyl acetal

The reactions have been studied in a high vacuum apparatus by the static method. It has been proved that the pressure increase inside the reaction vessel may be considered as a reasonable measure of the acetal consumed; consequently, the kinetic constants have been determined from the pressure increase-time curves.

Metcalf Research Lab., Brown U., Providence, R. I.
THE DISSOCIATION ENERGY OF FLUORINE FROM SHOCK WAVE MEASUREMENTS, by Kurt L. Wray and Donald F. Hornig. Technical rept. no. 5 on Contract Nonr-562(06). 1 Feb 58, 31p. 10 refs. AD-154 578.
Order from LC mi$3.00, ph$6.30 PB 138 329

In general, the heat of dissociation of fluorine determined by various workers falls into one of two ranges, the one from 60 to 70 kcal/mole, the other from 30 to 40 kcal/mole. The results of this research indicate that the lower range of values is correct.

Minnesota U., Minneapolis.
Be-C EQUILIBRIA, by R. L. Dowdell. Progress rept. no. 6 on NEPA Proj. AC-2017. 15 Oct 48, declassified 12 Nov 58, 19p. NEPA 794-UM-6; AD-204 967.
Order from LC mi$2.40, ph$3.30 PB 138 462

The study of the system Be-C has been continued with emphasis on the stability of the carbide Be_2C and also its lattice dimensions. Other carbides with Be have not been found, and it now appears certain that Be_2C is the only carbide in the system which is in equilibrium with either excess Be or graphite from room temperature to 2500°F. The new Picker Diffraction X-ray Machine is operating very well and is giving precision measurements by back reflection technic which are very consistent and accurate.

Minnesota U., Minneapolis.
Be-C EQUILIBRIA, by R. L. Dowdell. Progress rept. no. 7 on NEPA Proj. SC-2017. 29 Nov 48, declassified 12 Nov 58, 13p. NEPA 833-UM-7; AD-204 966.
Order from LC mi$2.40, ph$3.30 PB 138 458

The study of the system Be-C is being continued with emphasis on the Be end of the diagram, with the idea that it would be well to find some liquidus and solidus points for alloys containing mechanical mixtures of phases which appear to be Be and Be_2C. (See also PB 138 462)

Minnesota U., Minneapolis.
Be-C EQUILIBRIA, by R. L. Dowdell. Progress rept. no. 8 on NEPA Proj. SC-2017. 15 Dec 48, declassified 12 Nov 58, 18p. NEPA 859-UM-8; AD-204 965.
Order from LC mi$2.40, ph$3.30 PB 138 459

Most of the work has been with hot pressed compacts of Be_2C and graphite prepared by other workers in the field. This staff is endeavoring to determine the structure and the nature of the bond in these compacts. The specimens received from Nepa were labeled "Runs 77 and 80" and were made from mixtures of 20% Be_2C plus 80% graphite. These hot compacts were made at 2300°C for 30 minutes. (See also PB 138 458)

North Carolina U., Chapel Hill.
ADSORPTION IN POLAROGRAPHY, by Charles N. Reilly and Werner Stumm. Technical note UNC Chem no. 3 on Contract AF 49(638)333. 19 Oct 59, 44p. 91 refs. AFOSR-TN-59-1113.
Order from LC mi$3.30, ph$7.80 PB 144 383

Surface active substances, even in trace quantities, can exert a marked and often insidious effect on electrode processes. In polarography, adsorption of such substances at the electrode may decrease the limiting current, shift the half wave potential and in some cases obliterate the entire wave! In addition, they can cause minima or deceiving split waves. The characterization of the mode by which these effects arise and how one may detect their origin constitutes the purpose of this discussion.

North Carolina U., Chapel Hill.
ELECTRICAL METHODS OF ANALYSIS, by Charles N. Reilley. Final rept. for 1 June 54-30 June 58 on Contract AF 18(600)1160. 29 Aug 59, 8p. 22 refs. AFOSR-TR-59-128.
Order from LC mi$1.80, ph$1.80 PB 144 349

During the nearly four years of research under this contract, important progress has been made toward understanding of the mechanism of electrode processes and a number of electrochemical methods -- especially those involving chelate reactions -- were developed. Also, several new procedures of analytical value have been discovered. Some of the results are briefly tabulated and summaries of all published papers covering the research are given.

North Carolina U., Chapel Hill.
METAL CHELATE STABILITY CONSTANTS OF AMINOPOLYCARBOXYLATE LIGANDS, by James H. Holloway and Charles N. Reilley. UNC rept. no. 2 on Contract AF 49(638)333. 11 Sep 59, 30p. 15 refs. AFOSR-TN-59-748.
Order from LC mi$2.70, ph$4.80 PB 144 499

The stability constants for the reaction between a series of divalent metal ions with cyclohexanediaminetetraacetic acid (CyDTA), diethylenetriaminepentaacetic acid (DTPA), ethyleneglycol bis-(β-aminoethyl ether)-N, N'-tetraacetic acid (EGTA), ethylenetherdiaminetetraacetic acid (EEDTA), and N-hydroxethylethylene-diaminetriacetic acid (HEDTA) have been determined potentiometrically with a mercury electrode. The stability constants for the reaction between lanthanum and diethylenetriaminepentaacetic acid has also been determined by the same method.

Noyes Chemical Lab., U. of Illinois, Urbana.
TEMPERATURE DEPENDENCE OF PROTON RELAXATION TIMES IN AQUEOUS SOLUTIONS OF PARAMAGNETIC IONS, by Robert A. Bernheim, Thomas H. Brown and others. Technical rept. no. 15 on Contract Nonr-1834(13). 9 Oct 58, 26p. 19 refs. AD-205 747.
Order from LC mi$2.70, ph$4.80 PB 144 432

The nuclear magnetic relaxation times of protons in aqueous solutions of paramagnetic ions were measured as a function of temperature. For Mn^{++} ions, the proton T_1 and T_2 were measured at 10, 20, and 28 Mc/sec, and for Co^{++}, Cu^{++}, and Gd^{+++} ions, 20 Mc/sec. The temperature effects observed can be explained by incorporating the proper temperature dependences of the several correlation times into the general Bloembergen-Solomon relaxation expressions. Analysis of the data by means of the equations developed provides information concerning the chemical exchange of solvent protons with those in the hydrated Mn^{++} ion. An activation energy of 5.2 kcal/mole and other parameters for this process are evaluated. The temperature dependence of T_1 and T_2 in the Co^{++}, Cu^{++}, and Gd^{+++} solutions can be explained by the temperature dependence of the dipolar interaction alone. Varying the anion in Cu^{++} solutions had little effect on the T_1 or its temperature dependence; also, T_1 for Cu^{++} solutions was found to vary inversely with concentration over the whole temperature range studied.

Oklahoma State U., Stillwater.
RESEARCH IN PHOTOCHEMICAL AND PHOTOEMISSION PROCESSES IN NITROAROMATICS AND IN OTHER COMPOUNDS, by Earl H. Gilmore. Final rept. for 15 Sep 55-31 Aug 58 on Contract DA 23-072-ORD-581. Sep 58, 72p. 45 refs. AD-209 626.
Order from LC mi$4.50, ph$12.30 PB 144 331

None of the results of a complete analysis requiring seven different emission data from the system esculin in glucose glass indicates that the Jablonski model is invalid for the system. A large fraction of the quenching occurring in the system studied occurs from the singlet level. Nonradiative processes can occur from either the excited singlet or the excited triplet level of a molecule. The rate constant for the excited singlet to triplet level transition must be in the order of magnitude of the values of the rate constants for the singlet to ground level transitions if phosphorescence is appreciable.

Pennsylvania State U., University Park.
SIGMA VALUES AND THE EFFECTS OF STRUCTURE ON REACTIVITY. A REVIEW OF DEVELOPMENTS FOR 1957, by Robert W. Taft, Jr. Technical rept. no. 18 on Contract Nonr-656(05). Feb 58, 45p. 123 refs. AD-153 774.
Order from LC mi$3.30, ph$7.80 PB 138 337

Consideration is given to the evaluation of resonance effects, hyperconjugative and conjugative, in both the aromatic and aliphatic series; the determination of the extent of steric inhibition of resonance; the determination of steric inhibition of solvation; the evaluation and correlation of kinetic and potential energy intramolecular steric effects; and the evaluation of driving forces involved in anchimeric assistance (neighboring group participation).

Rensselaer Polytechnic Inst., Troy, N. Y.
FUSED SALT CHEMISTRY, by George J. Janz. Technical note no. 11 on Contract AF 49(638)50. Aug 59, 31p. 27 refs. AFOSR-TN-59-880; AD-226 418.
Order from LC mi$3.00, ph$6.30 PB 143 924

To be published as part of the proceedings of this meeting by the Stamford Research Institute, Menlo Park, Calif. Molten salts from systems which are liquid at temperatures up to 3000°C at atmospheric pressure. They form the largest class of non-aqueous inorganic solvents. The present communication develops some aspects of the structure of molten salts which are of current interest among both theoretical and experimental research workers. The models for molten salts based on liquid state theories and on the electro-chemical properties of these systems are considered. Experimental methods, the information to be gained, and current problems in the fields of pure molten salts, and mixtures are surveyed.

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
BLUFF-BODY FLAME STABILIZATION AT LOW PRESSURES, by C. C. Chang, G. Engholm, and L. H. Zacho. Rept. on Contract AF 18(600)1553. July 59, 61p. 24 refs. Research rept. no. 161; AFOSR-TR-59-111.
Order from LC mi$3.90, ph$10.80 PB 144 346

Blowoff velocities of butane-air flames stabilized on a 3/16 inch diameter cylindrical flameholder were measured as a function of pressure (1/10 to 1 atm) and equivalence ratio for Reynolds numbers ranging from 1945 to 4685. Within this laminar range it was found that blowoff velocity was directly proportional to pressure for equivalence ratios from 0.9 to 1.5 and inversely proportional to pressure for equivalence ratios less than 0.9 or greater than 1.5.

Ultrasonics Research Lab., Western Reserve U., Cleveland, Ohio.
QUANTITATIVE MEASUREMENTS OF COLLOIDAL VIBRATION POTENTIALS, by Joseph Dereaka, Ernest Yeager, and Frank Hovorka. Technical rept. no. 20 on Contract Nonr-1439(04). 1 Dec 58, 30p. 16 refs.
Order from LC mi$2.70, ph$4.80 PB 143 858

When ultrasonic waves are transmitted through a colloidal suspension in an aqueous medium, alternating potential differences are produced between points separated by a phase distance other than an even multiple of the wavelength. Quantitative measurements of this effect have been made in colloidal silica suspensions. Light scattering, electron microscopy, electrophoresis, and conductivity measurements have been made on the various silica suspensions to determine particle size and charge. Experimental results are in relatively good agreement with theory for measurements in suspensions of moderately high conductance. Agreement is less favorable for solutions of low conductivity.

Geochronometric Lab., Yale U. [New Haven, Conn.]
RADIOCARBON DATING. Final rept. on Contract Nonr-609(05). Jan 58, 16p. 13 refs. AD-154 472.
Order from LC mi$2.40, ph$3.30 PB 138 258

Consideration is given to the instrumental, geochemical, and dating problems in radiocarbon dating. The advantages and use of the CO_2 proportional-counting method are discussed.

Climatology and Meteorology

Electrical Engineering Research Lab., U. of Texas, Austin.
THE USE OF POTENTIAL REFRACTIVE INDEX IN SYNOPTIC-SCALE RADIO METEOROLOGY, by K. H. Jehn. Rept. on Contract AF 19(604)2249. 15 Sep 59, 22p. 3 refs. Rept. 6-29; AFCRC-TN-59-598.
Order from LC mi$2.70, ph$3.80 PB 144 279

The concept of potential refractive index is examined in the light of earlier work and of the present emphasis on synoptic-scale radio meteorology. A new potential refractive index is defined and illustrated. It is concluded that the new parameter has operational utility in long range microwave radio and radar transmission, as well as in refractive index mapping.

Florida State U., Tallahassee.
THE EFFECT OF THE VERTICAL VARIATION OF WIND AND STABILITY ON MOUNTAIN WAVES, by Bo R. Döös. Technical rept. no. 13 on Contract Nonr-1600(00). 30 Dec 58, 36p. 19 refs.
Order from LC mi$3.00, ph$6.30 PB 144 230

The motion over an infinitely long mountain ridge has been studied. The scale of the motion is assumed to be so small that the influence of the earth's rotation can be neglected. It is further assumed that the motion is non-viscous, laminar, steady, and isentropic. The resulting wave equation is solved for certain types of realistic wind and temperature distributions. The wave lengths and the amplitudes have been evaluated for seven different cases which have been selected so that the effect of variation on the wind profile and the temperature distribution can be studied separately.

Florida State U., Tallahassee.
SOME EFFECTS OF THE WESTERN CORDILLERA OF NORTH AMERICA ON CYCLONIC ACTIVITY IN THE UNITED STATES AND SOUTHERN CANADA, by E. Paul McClain. Technical rept. no. 12 on Contract Nonr-1600(00). 15 Dec 58, 64p. 28 refs.
Order from LC mi$3.90, ph$10.80 PB 143 857

This report presents the results of an investigation which sought more satisfactory physical explanations for the observed behavior of cyclonic storm systems over and in the vicinity of the Western Cordillera of North America. Smoothed terrain contours were constructed and then used to estimate where and under what synoptic conditions orographically induced vertical motions might systematically alter the vorticity tendency field. Two general hypotheses evolved from the analysis: (1) Lee cyclogenesis. --A low-level lee-side trough is established and positive vorticity tendencies are generated in this region by the nature of the orographic vertical velocities. Whether or not major cyclonic storms develop from this trough is dependent upon the subsequent superposition of high-level divergence. (2) Windward retardation and cyclolysis. --Mature cyclones approaching the windward slopes decelerate, recurve northward and weaken due to the combined action of low-level orographic vertical velocities, friction, and the relatively unimpeded progression of the high-level portion of the system. A detailed case study is presented to illustrate and, to some extent, to verify the hypotheses outlined above as well as some other synoptic-scale mountain effects.

Institute for Advanced Study, Princeton, N. J.
ATMOSPHERIC RADIATION PROJECT, by Lewis D. Kaplan. Final interim rept. for 1 Feb 54-31 Aug 57 on Contract Nonr-1358(01). [1957] 6p. 5 refs. AD-143 331.
Order from LC mi$1.80, ph$1.80 PB 138 231

The spectral characteristics of the 3 principal absorbing gases in the atmosphere (carbon dioxide, ozone, and water vapor) that would be necessary to investigate radiative heat transfer were studied. New measurements by Eggers were used to determine the 15-μ band intensity and mean line width for CO_2 (J. Chem. Phys. 25:876-883, 1956). Intensities for 3 satellite bands of CO_2 were calculated (J. Chem. Phys. 26:1252-1253, 1957). The O_3 spectra of the 9.6 μ band were successfully analyzed for rotational structure. Line widths were calculated for all water vapor lines; an intensity analysis should produce the basic data necessary for the calculation of the heat transfer. The heat balance of the lower stratosphere was investigated.

McGill U. (Canada).
A SYNOPTIC CLIMATOLOGY FOR LABRADOR-UNGAVA, by Roger G. Barry. Scientific rept. no. 4 on Contract AF 19(604)3865. Aug 59, 256p. 89 refs. Arctic Meteorology Research Group Pub. in Meteorology Research Group Pub. in Meteorology no. 17; McGill Sub-Arctic Research Papers no. 8; AFCRC-TN-59-602.
Order from LC mi$11.10, ph$39.60 PB 144 275

A classification of airflow pattern types is formulated for the region on the basis of synoptic weather maps for November, 1956 to March, 1958. Regional indices of the zonal and meridional flow at mean sea level and the 500 mb level are examined in relation to the airflow types. The spatial and temporal variations of weather phenomena associated with the types are analyzed by quantitative weather parameters and the significance of the results is assessed with reference to local weather forecasting and palaeoclimatic reconstruction. (See also PB 142 028)

Marine Lab., U. of Miami, Coral Gables, Fla.
RADAR METEOROLOGICAL STUDIES, by H. W. Hiser and P. R. Ray. Final rept. for 1 Feb 58-31 Jan 59 on Contract NOas-58-388-d. [1959] 116p. 22 refs. Rept. no. 8904-4.
Order from LC mi$6.00, ph$18.30 PB 144 255

A range corrected logarithmic radar receiver, a master power supply, and an I. F. pulse generator, which were developed under the contract, are described and schematics are presented. Research on anomalous propagation and "thin bands" is described. A comparison of observations on the CPS-9, SP-1M, and MPS-4 radars and a summary of radar observations of 1958 hurricanes that approached South Florida are also included.

Marine Lab., U. of Miami, Coral Gables, Fla.
STUDIES OF THE EVOLUTION AND MOTION OF HURRICANE SPIRAL BANDS AND THE RADAR ECHOES WHICH FORM THEM, by H. V. Senn, H. W. Hiser, and E. F. Low. Final rept. for 1 July 58-30 June 59 on Contract Cwb-9480. Aug 59, 68p. 28 refs. ML-59169; AD-227 258.
Order from LC mi$3.90, ph$10.80 PB 144 247

Studies of radar echo vector motion in relation to a stationary hurricane center have been made for 1573 echo trajectories from hurricanes Edna 1954, Connie, Diane, and Ione 1955, Audrey 1957, and Daisy and Helene 1958. The data indicate that echo trajectories, while generally down spiral bands, have crossing angles which are smaller than those found for spiral bands in previous studies. Furthermore, the radius of a point on a spiral band (not an individual echo) in a given quadrant increases with time, resulting in an outward motion of the band. Preliminary results of several attempts to derive a mathematical model of echo-spiral band motion under various assumptions are also presented.

Naval Ordnance Test Station, China Lake, Calif.
OBJECTIVE FORECASTING OF CIRRUS CLOUDINESS AT THE NAVAL ORDNANCE TEST STATION, by D. L. Farnham. May 59, 18p. 6 refs. NOTS TP 2249; NAVORD rept. 6550.
Order from LC mi$2.40, ph$3.30 PB 144 177

The development of a rapid and relatively simple objective method of forecasting cirrus cloudiness at the Naval Ordnance Test Station, China Lake, California, is presented. Results of its use from March through May 1959 are shown. Conclusions that the method has forecasting advantages are reached.

New York U. Coll. of Engineering, N. Y.
AN ANALYSIS OF UPPER-AIR OBSERVATIONS AT McMURDO SOUND, ANTARCTICA, by James Demetrios Kangos. Scientific rept. no. 7 on Contract AF 19(604)1755. July 59, 33p. 19 refs. AFCRC-TN-59-451.
Order from LC mi$3.00, ph$6.30 PB 144 166

The height of the tropopause is determined at McMurdo Sound for January 1957 and July 1957 using three methods. The tropopause was found to be lower in summer than in winter. Mean temperature soundings for January 1957, July 1957, and October 1957 were determined to study the effect of the sun's rays on the heating of the Antarctic atmosphere. It was found that radiational heating of the atmosphere by the sun seemed to be the predominant process. Mean vertical wind profiles for July 1957 at McMurdo Sound reveal that the wind increases to the top of the sounding, whereas during January 1957 a wind maximum is present in the vicinity of the tropopause.

New York U. Coll. of Engineering, N. Y.
THE SPECTRA OF LARGE-SCALE TURBULENT TRANSFER OF MOMENTUM AND HEAT, by Wan-cheng Chiu. Scientific rept. no. 8 on Contract AF 19(604)1755. July 59, 29p. 11 refs. AFCRC-TN-59-452.
Order from LC mi$2.70, ph$4.80 PB 143 892

The spectra of large scale eddy transfer of angular momentum and heat were constructed for seven levels, ranging from 700 mb to 50 mb over Belmar, N. J., and at the 300 mb and 200 mb levels over Cocoa, Florida.

Woods Hole Oceanographic Institution, Mass.
CLOUD STRUCTURE AND DISTRIBUTIONS OVER THE TROPICAL PACIFIC, PART I, by Herbert Riehl, William S. Gray (U. of Chicago) and others. Technical rept. no. 5 on Contracts [Nonr] 1731(00), N6ori-02036, and Cwb 9509. Jan 59, 131p. Reference no. 58-62.
Order from LC mi$6.90, ph$21.30 PB 144 191

This report contains, in addition to description of purpose and method of the inquiry, the preliminary results of the first flight. Subsequent reports will be issued on the two remaining flights and containing an overall summary and comparison. It is intended that all three will be combined finally in a single publication.

Frost Science

Army Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
A THERMALLY CONTROLLED SOIL FREEZING CABINET, by J. H. Schmertmann. May 58, 39p. Technical rept. 50; AD-208 955.
Order from LC mi$3.00, ph$6.30 PB 144 195

A cabinet providing good thermal control for one-dimensional heat-transfer experiments, control of water access to the sample, proper instrumentation, and adequate utility is described together with theoretical studies and tests conducted during its developemnt.

Institute of Engineering Research, U. of California, Berkeley.
PROGRESS REPORT FOR THE YEAR ENDING JUNE 27, 1953, by R. V. Dunkle and J. T. Gier. Rept. for 27 June 52-27 June 53 on Contract DA-11-190-eng-3. 27 June 53, 74p. 12 refs. Series no. 62,

issue no. 1.
Order from LC mi$4.50, ph$12.30 PB 144 463

The basic activities are: (1) a study of the spectral characteristics of wet and dry snow and the total emissivities and absorptivities of wet and dry snow for temperatures between 0°C and -60°C; (2) the study of the radiant characteristics of various types of paints and materials which might be used in arctic conditions; and (3) determination of criteria for the selection of materials, coatings and clothing for arctic camouflage and for identification under arctic whiteout conditions.

Institute of Engineering Research, U. of California, Berkeley.
RADIATION IN A DIFFUSING MEDIUM WITH APPLICATION TO SNOW, by R. V. Dunkle and J. T. Gier. Rept. on Contract DA 11-190-eng-3. 15 Nov 53, 16p. 3 refs. Series no. 62, issue no. 2.
Order from LC mi$2.40, ph$3.30 PB 144 462

The transmission through an idealized snow cover has been shown to be directly related to the albedo and to be an exponentially decreasing function. Two parameters have been proposed as possible correlating factors for transmission and albedo measurements. The first factor is a characteristic of the surface condition of the cover and the second is a characteristic of the snow beneath the surface. (See also PB 144 463)

Geography

California U., Berkeley.
NOTES ON THE CHIRIQUI LAGOON DISTRICT AND ADJACENT REGIONS OF PANAMA, by Burton Leroy Gordon. Rept. on Contract Nonr-222(11). 1957, 30p. 16 refs. AD-143 127.
Order from LC mi$2.70, ph$4.80 PB 138 226

A report is given of the observations made on a trip from Santa Fe to Calovebora, Panama. The terrain, the flora, the population, and the animals found in the area are described with special details about the Almirante Bay and Chiriqui Lagoon given. The Guaymi Indians cultivate a wax-producing scale insect, the Llaveia axin. A discussion is presented of the people engaged in the work, the habits of the insect, the uses and preparation of the wax, and the general industrial culture of the insect.

California U., Berkeley.
NOTES ON THE GEOGRAPHY OF BARBADOS, by Edward T. Price. Rept. on Contract Nonr-222(11). 1958, 62p. 41 refs.
Order from LC mi$3.90, ph$10.80 PB 144 257

Contents:
Man in Barbados
Shorelines, present and past
Earth movements in the Scotland District

California U., Berkeley.
QUINTANA ROO: MEXICO'S EMPTY QUARTER, by Clinton R. Edwards. Rept. on Contract Nonr-222(11). 1957, 189p. 62 refs. AD-143 122.
Order from LC mi$8.40, ph$28.80 PB 137 549

An investigation is made to find an explanation for the abandonment of Quintana Roo's agricultural lands. A geographic description is given of present-day Quintana Roo which includes the geomorphology, climate, vegetation, and soils of the area as well as its population and economic situation. Some similarities and contrasts are pointed out between Yucatan (AD-84 112) and the territory. A discussion is presented on the disparity in population between this territory and Yucatan, which in a smaller area harbors almost 20 times as many people. Besides the general bibliography, references are included at the end of every main subtopic.

Sacramento State Coll., Calif.
GEOGRAPHY OF INDIAN COASTS, by David E. Sopher. Annual summary rept. on Contract Nonr-2329(00). 1958, 18p.
Order from LC mi$2.40, ph$3.30 PB 144 270

This report is confined to observations and conclusions concerning historical and contemporary cultural interrelationships among the strand communities of these areas.

Oceanography

Johns Hopkins U. School of Engineering, Baltimore, Md.
AN ADVECTIVE MODEL OF THE OCEAN THERMOCLINE, by Pierre Welander. Technical rept. no. 7 on Contracts Nonr-248(31) and CWB-9504. Dec 58, 31p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 143 983

A theoretical study is made of the density field and the associated velocity field produced in an unlimited ocean by a prescribed density distribution at the surface. It is assumed that all motions take place under geostrophic and hydrostatic balance, and that the density is simply advected by the motion. The computation is carried out for a spherical earth.

Oregon State Coll., Corvallis.
BIOCHEMISTRY OF MARINE ORGANISMS, by Vernon H. Cheldelin. Rept. for 1 Jan-31 Dec 58 on Contract Nonr-1286(06). 10 Jan 59, 2p.
Order from LC mi$1.80, ph$1.80 PB 144 256

A summary.

Scripps Inst. of Oceanography, U. of California, La Jolla.
MARINE MICROBIOLOGY, by Claude E. ZoBell and

Leslie Ralph Berger Progress rept. no. 12 (Annual), 1 Jan-31 Dec 58, on Physiological Activities of Marine Bacteria, Contract Nonr-2216(00). 31 Dec 58, 13p. 11 refs. Reference 59-1.
Order from LC mi$2.40, ph$3.30 PB 144 197

Suitable apparatus and procedures have been developed to permit the study of microbial activities at hydrostatic pressures up to 2000 atm. Although some cultures of marine and terrestrial bacteria can grow at pressures as high as 800 atm, prolonged incubation at these pressures is lethal to most organisms. Some deep sea forms, termed barophiles, appear to reproduce only under increased pressure. The morphology of growing cells in pure culture at different pressures has been observed. At increased hydrostatic pressure, protoplasmic synthesis appears to be less inhibited by pressure than is cell-wall formation and cell division. The result is the formation of abnormally large cells, chains of cells, and snake forms. In some cases the cells appear to lyse from "over-growth" The microbial populations in marine sediments have been carefully screened both for the physiological types of bacteria and for their numbers. A number of enzyme systems have been studied under increased pressure. Several cultures of marine bacteria appear to exhibit an unusual growth response to temperatures. When total growth of a culture or its growth rate was plotted against the temperature of the culture, a bimodal curve was obtained. (See also PB 127 188)

Texas A. and M. Research Foundation, College Station.
DIAGENETIC MODIFICATION OF CLAY MINERAL TYPES IN ARTIFICIAL SEA WATER, by U. Grant Whitehouse and Ronald S. McCarter. Technical rept. on Oceanographic Survey of the Gulf of Mexico, Contract N7onr-48702. Mar 57, 65p. 33 refs. Reference 57-5T; AD-134 148.
Order from LC mi$3.90, ph$10.80 PB 137 559

Electron diffraction, electron miscroscopy, X-ray diffraction, and chemical analysis were used for detecting and measuring the extent of modification of clay materials at selected time intervals during a 5-yr period. Relative weight percents of 18.2 for chloritic-clay separates and 4.4 for illitic-clay separates were obtained after more than 4 yr of treatment. Chemical-analysis and electron-microscopy data suggested that latticular alteration preceded the development of 40 to 70% of the chloritic and illitic materials separated. The modification of montmorillonitic clay was more dependent upon the Mg-K ratio in sea water than upon the total salt-concentration levels. The limiting Mg-K ratio was approximately 9.4 with a limiting low K concentration of 0.005 mol/1 for montmorillonitic material of less than a 0.5-μ settling diameter. The alteration of the montmorillonitic material was noted only for material that was initially settled through the artificial sea water columns. As the K concentration level of sea water dropped by extraction below 0.005 M, a bulk effect of the settling clay material became operative, and the relative percentage of altered clay material decreased. Further, the relative amounts of modified clay material detected were decreased by the introduction of carbohydrate material into the sea water media. The amounts present after a definite time interval were dependent upon the distributive tendencies of the source clay materials and the physical disturbance of the clay sea water systems. Resuspension of the clay material by reagitation of the systems decreased and significantly governed the rate of diagenetic modification.

Physics of the Atmosphere

Air Force Cambridge Research Center, Bedford, Mass.
THE ARDC MODEL ATMOSPHERE, 1959, by R. A. Minzner, K. S. W. Champion and H. L. Pond. Aug 59, 151p. 141 refs. Air Force Surveys in Geophysics no. 115; AFCRC-TR-59-267.
Order from OTS $2.75 PB 161 305

A model of the earth's atmosphere to 700 kilometers is given. Below 53 kilometers the present model is the same as The ARDC Model Atmosphere 1956. Above this height, changes have been made based on data deduced from rocket flights and from the rate of change of the orbital period of satellites. At approximately 600 kilometers the new model gives densities that are 20 times higher than the 1956 model. Below 600 kilometers the two models gradually come closer together and finally cross at about 150 kilometers. Between 90 and 150 kilometers the density for the 1959 model is lower, being about one half that of the 1956 model at 120 kilometers. At the present time, the maximum altitude at which density data from satellites has been obtained is just below 700 kilometers. For this reason, the tables end at 700 kilometers. Dashed lines in the plots present a tentative extrapolation of the data to 1000 kilometers. The value of the molecular weight, like other atomspheric properties, probably depends on both location and time. The 1959 model curve probably represents the molecular weight at high latitudes, such as Fort Churchill, where the experimental data were obtained. At lower latitudes the molecular weight may be nearer the curve given in the 1956 model.

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
INTERNATIONAL SYMPOSIUM ON ATMOSPHERIC DIFFUSION AND AIR POLLUTION, 24-29 AUGUST 1958, OXFORD, ENGLAND, by H. G. Booker. Technical rept. no. 48 on Studies on Propagation in the Atmosphere, Contract DA 36-039-sc-74903. 23 Sep 58, 76p. 26 refs. Research rept. EE 388.
Order from LC mi$4.50, ph$12.30 PB 144 174

Papers on the following topics were given at this symposium: (1) General survey of atmospheric diffusion and pollution; (2) recent findings on atmospheric turbulence; (3) theory of turbulent diffusion; (4) diffusion of heavy or finite particles; (5) vertical transfer through the troposphere and stratosphere; (6) effects of thermal stratification on diffusion; and (7) pollution patterns from point and area sources.

Ionosphere Research Lab., Pennsylvania State U., University Park.
A COMPUTER PROGRAM FOR OBTAINING REFRAC-

TIVE INDICES AND POLARIZATIONS FROM THE APPLETON-HARTREE EQUATIONS AND MAGNETO-IONIC TABLES FOR CAPE CANAVERAL, by E. A. Mechtly. Scientific rept. no. 116 on Ionospheric Research, Contract DA 36-061-ORD-577. 15 Feb 59, 69p. 3 refs.
Order from LC mi$3.90, ph$10.80 PB 144 242

Program Cc 126 for the Pennsylvania State University's digital computer PENNSTAC is given. This program has been prepared for the computation from the Appleton-Hartree equations of magneto-ionic refractive indices and polarizations for both modes of propagation. Instructions for using this program are given. Magneto-ionic tables for Cape Canaveral, Florida are presented. These tables have been compiled for use in conjunction with the Ionosphere Research Laboratory's project for the determination of electron densities in the ionosphere by means of rockets.

Ionosphere Research Lab., Pennsylvania State U., University Park.
IONOSPHERIC ELECTRON DENSITIES FOR WASHINGTON D. C., PANAMA, TALARA, AND HUANCAYO FOR JANUARY-FEBRUARY-MARCH, 1958, by E. R. Schmerling. Scientific rept. no. 122 on Ionospheric Research, Contract AF 19(604)3875. 15 Aug 59, 245p. 3 refs. AFCRC-TN-59-603.
Order from LC mi$11.10, ph$37.80 PB 144 164

These tables have been computed from routine ionograms by the matrix method of Budden (1955). The details of the method as used here are more fully discussed by Schmerling (1957). 40x40 matrices were used, two matrices being computed for each station, to cover the ranges 1.6(0.2)9.6 mc/s. and 2.0(0.5)22 mc/s. For F2 critical frequencies below 10 mc/s. the former matrices were used, and for F2 criticals above 10 mc/s, the latter. In addition, if significant structural details were seen on ionograms with F2 criticals above 10 mc/s. the former matrices were used to determine the profiles in greater detail below 10 mc/s. The method takes full account of the earth's magnetic field, but ignores electronic collisions. No assumptions are made as to profile shape other than a monotonic variation of electron density with height.

Minnesota U., Minneapolis.
WINDS AND WIND STRUCTURE AT 100,000 FEET FROM CONSTANT ALTITUDE BALLOON TRAJECTORIES, by Homer T. Mantis. Final scientific technical rept. on Atmospheric Physics, Contract AF 19(604)2207. Apr 59, 255p. 4 refs. AFCRC-TR-59-243; AD-214 594.
Order from LC mi$11.10, ph$39.60 PB 144 323

The wind data from constant altitude balloon trajectories were analyzed by 2 methods. The structure of the winds on what might be called a conventional meteorological scale was made by measuring 3-hr average winds (some slightly longer or shorter if the fixes were irregular in time), from the trajectories plotted on the maps at 1:500,000 scale. By using a 3-hr period, the accuracy of the velocities is quite high and most of the remaining variation is comparable to the scale of motion analyzed on synoptic maps. The second type of analysis of the wind structure was an investigation of motions of smaller scale. The existence of smaller scale motions is quite evident in the trajectories at low wind speeds. Several of the flights show complete closed loops in the trajectories. To systematize the observations of wind structure at smaller scale, a type of spectral analysis of the wind measurements was made for higher level flights with camera trajectories.

New York U. Coll. of Engineering, N. Y.
THE SEMIDIURNAL PRESSURE OSCILLATION IN THE STRATOSPHERE, by B. Haurwitz. Scientific rept. no. 7 on Contract AF 19(604)1738. Oct 58, 18p. 3 refs. AFCRC-TN-58-603; AD-206 331.
Order from LC mi$2.40, ph$3.30 PB 137 889

The semidiurnal pressure oscillation was computed for one station pair in the southern U. S. at the 250- and 175-mb level, and for another in the tropical Pacific at the 200-mb level. The accuracy of these values of S_2 is not very great because of the lack of sufficient data. Values show that the pressure maximum is retarded aloft by about 1.5 hr, and that the amplitude increases upwards, in agreement with earlier conclusions based on data from the Caribbean.

ENGINEERING

Bureau of Yards and Docks, Washington, D. C.
WATER SUPPLY FOR ADVANCED BASES. 1 Nov 52, 62p. 7 refs. Technical pub. NAVDOCKS TP-PL-6.
Order from LC mi$3.90, ph$10.80 PB 144 110

This publication is developed as a guide to the selection of equipment that is available for the collection, treatment, and distribution of water (primarily for potable purposes) at advanced bases. It should prove very useful to the officer who is responsible for selecting the proper type and size of equipment for each set of circumstances and for making up allowance lists for various requirements, also to the officer in the field who has charge of water supply systems. This publication contains adequate descriptions of available equipment recommended for both temporary and semipermanent advanced bases, and establishes the criteria that govern the selection of particular systems and equipment for specific cases.

Institute of Tech., U. of Minnesota, Minneapolis.
SURVEY AND EVALUATION OF POWER SOURCES SYSTEMS. PART III. MECHANICAL COMPONENTS, by Adolph O. Lee, M. M. El-Wakil, and William A. Kleinhenz. Rept. for 15 Sep 53-1 Dec 55 on Contract DA 36-039-sc-56649. 1955,131p. 127 refs.
Order from LC mi$6.90, ph$21.30 PB 144 505

Mechanical components of power source systems are limited to those devices or means of transmitting power from a driving unit or prime mover to an electrical generator. Elastic energy storage has been investigated in two forms - solid material elasticity and liquid compressibility. At the present time solid ma-

terial elasticity in the form of springs is the more practical. Springs serve well as a form of storage energy in limited amounts. Liquid compressibility will need further development before its use will become practical. Wind power has had the benefit of years of experimentation, but has not developed into a major means of providing power. Neither atmospheric pressure variations nor atmospheric temperature variations was found to contribute significantly as a potential energy source. An estimate of the potential availability of the energy consumed by man is provided in the report.

Aeronautical Engineering

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EMERGENCY ESCAPE CAPSULE STUDIES. PHASE I. PRELIMINARY LABORATORY FLOTATION STUDIES, by Allan P. Kearney, Billy J. Mills, and Ronald S. Huey. Rept. on Integration of Personal Equipment. June 59, 21p. WADC Technical rept. 59-247(I); AD-226 055.
Order from OTS $0.75 PB 161 042

Preliminary studies using aircraft canopy escape-type capsules are described. Design of capsule clothing, donning of clothing in confined space, stowage of emergency survival items, air exchange requirements, flotation, inhabitation and communication studies were conducted as individual facets of the program. The studies were culminated with a test in which a human subject remained in a closed capsule for 72 hours. Findings from these preliminary studies are presented. The capsule with an air exchange system successfully served as a temporary shelter while floating in a test pool for a period of 72 hours. Throughout the test, the hatch was closed to simulate a situation which might be necessary operationally only as a result of the most severe environmental conditions.

American Brake Shoe Co. [New York]
DEVELOPMENT OF LOW ALLOY STEEL COMPOSITIONS SUITABLE FOR HIGH STRENGTH STEEL CASTINGS, by Hugo R. Larson, Ronald C. Campbell, and Herbert W. Lloyd. Rept. for July 58-Jan 59 on Metallic Materials, Contract AF 33(616)5299. June 59, 116p. WADC Technical rept. 59-63.
Order from OTS $2.50 PB 161 044

Cast high strength alloy steels were investigated to develop compositions which had 12% elongation, 30% reduction of area and 15 ft. lb. impact strength when heat treated to 180,000 psi tensile strength. In addition the ultra high strength level was studied to determine the tensile strength at which a reduction of area in excess of 10% could be maintained. A series of alloys based primarily on 4340 were poured. The optimum carbon content was established at approximately 0.35%. High purity raw materials had a definite beneficial effect on ductility both at the 180,000 psi and the ultra high strength level. Two vacuum melted heats met all of the above requirements quite easily. Air hardening die type steels were also investigated. Exceptionally good properties were obtained with high purity raw materials and a base analysis of about .30% carbon, 5% chromium, 1.50% molybdenum and 0.50% vanadium. Simple plate castings of varying thickness and length were poured to investigate the feeding characteristics of the 8740 type steel. Tensile bars cut from the castings had properties which correlated well with radiographic soundness of thin slices cut adjacent to the tensile specimens. Both the 8740 and the 5% chromium steels were poured in three typical airframe castings. Tensile properties in the castings were not as good as from test bars.

Army Chemical Warfare Labs., Army Chemical Center, Md.
CONDENSATION TRAIL ELIMINATION, by Bernard E. Simonson and Robert H. Frickel. Sep 59, 33p. 19 refs. CWLR 2304.
Order from LC mi$3.00, ph$6.30 PB 144 107

A theoretical and experimental study was conducted on the elimination of aircraft condensation trails. Various materials were added to the exhaust stream of a laboratory model pulse jet generator which burned JP-4 jet fuel. The exhaust products were conducted into a cold chamber maintained at -50°F where nuclei produced from (1) sublimating silver iodide, (2) a solution containing silver iodide, (3) a hydrophilic colloid, (4) a household detergent, and (5) reacting metallic silver with iodine were added to the exhaust. Most promise was shown when a solution containing silver iodide was injected into the exhaust stream. The optical density of the condensed cloud was decreased by 38.9% when compared to an untreated cloud.

Army Transportation Research and Engineering Command, Fort Eustis, Va.
HELICOPTER WEIGHT AND LOAD COMPUTER, by Gene C. Moen. June 59, 36p. Proj. 9-38-01-000, House Task 12.90.
Order from LC mi$3.00, ph$6.30 PB 144 128

This report contains an evaluation of the design and arrangement of a helicopter weight and load computer and a discussion of the development of optimum features for a computer. Results of the engineering and performance evaluation reveal that additional development of the computer body is required and that the optimum means of presenting the computer scale should be determined. It was concluded that a computer based on the technical characteristics, included in the report, will satisfy the Army's requirement for a helicopter weight and load computer. A contract has been let for the development of an optimum configuration of the computer.

Bureau Technique Zborowski (France).
THEORETICAL INVESTIGATION AND EXAMINATION BY MEASURING TESTS OF THE THRUST CONTROL BY RUDDERS UNIFORMLY FITTED AT THE OUTLET OF A DUCT. Final technical rept. for 1 July 58-30 Sep 59 on Contract DA 91-508-EUC-394. 10 Oct 59, 86p. 9 refs.
Order from LC mi$4.80, ph$13.80 PB 144 249

It is of great importance for VTOL aircraft to dispose at any moment of its ascensional or, at hovering flight, of the full thrust of the motor aggregate. In the case of COLEOPTERS, the ring airfoil permits fitting rudders at the outlet which can assume the role of control surfaces not only for changes of direction, but also for modification of the thrust. A computation method is given which is based on potential-flow theory, permitting the calculation of the thrust reduction in function of the rudder configuration (relative depth and deflection angle) and the flight speed. The method cannot take due account of viscosity influences, necessarily occurring for higher flight speeds at greater rudder deflections. Indeed, flow separation on the back of the rudders seriously changes the computed values, restricting by the perturbations due to its action, even the domain of rudder depths and deflection angles to be admitted. Moreover, the zone occupied by the detached flow reduces in a large extent the control possibilities of the rudder, necessitating special devices to avoid this, as e.g. tangential blowing at the rudder hinge. It seems to follow from calculations as well as from tests that the most favorable results can be expected for rudder depths of approximately 20% of the total wing length and within a range of deflections bounded to 60°. More investigations on boundary-layer behavior and on questions of boundary-layer control in threedimensional flow seem absolutely indispensable for a more pertinent theory than that proposed here.

David Taylor Model Basin, Washington, D. C.
THE PLANING CHARACTERISTICS OF A V-SHAPED PRISMATIC SURFACE WITH 70 DEGREES DEAD RISE, by James D. Pope. Dec 58, 18p. 11 refs. Rept. 1285.
Order from LC mi$2.40, ph$3.30 PB 144 217

This report is one of a series on the experimental investigation of the planing characteristics of a series of related prismatic surfaces. The principal planing characteristics have been obtained for a V-shaped prismatic surface having an angle of dead rise of 70 degrees. Wetted lengths, resistance, and center-of-pressure location were determined at speed coefficients from 2.17 to 36.85, and trims up to 30 degrees. Keel-wetted-length-beam ratios were extended to approximately 8.0 in all cases where excessive loads or excessive spray conditions were not encountered.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
FUTURE APPLICATION TRENDS FOR TITANIUM AND STEEL IN MILITARY AIRCRAFT, by W. Stuart Lyman and Fred L. Bagby. 8 May 59. 7p. DMIC-M-17 memo. 17.
Order from OTS $0.50 PB 161 167

deFlorez Co., Inc., Englewood Cliffs, N. J.
EVALUATION OF EXPERIMENTAL POINT SOURCES AND TRANSPARENCIES FOR HELICOPTER HOVERING FLIGHT SIMULATION DEVICE 2FH2. Rept. on Contract Nonr-1628(00). Feb 59, 72p. Technical rept. NAVTRADEVCEN 1628-11.
Order from LC mi$4.50, ph$12.30 PB 144 272

The visual display produced by the point light source and transparency originally furnished for Device 2-FH-2, an experimental helicopter hovering flight simulation device, and the visual display produced by a new light source and transparency for that device were evaluated by pilots. These evaluations were then compared to determine the relative merits of the original set and the new set of components. An appraisal of the usefulness of such a device for training was obtained also. The improved resolution obtained with the new light source is preferable to the greater brightness of the original one. The photographic techniques used in preparing the new transparancy result in a more realistic display than that obtained with the wholly hand-decorated original transparency. The dished shape of the new transparency is much more rigid than the old one but detracts somewhat from the realism. Three-dimensional objects give the most important cues in the display with horizon and earth texture next in importance. The distortion known as "bowl effect" is the most objectionable distraction. Simulation of all sorts of ambient weather conditions is greatly to be desired for training purposes. Some cockpit motion, even though limited, will add significantly to the effectiveness of the display.

Douglas Aircraft Co., Inc., Long Beach, Calif.
A DESIGN STUDY OF AN AIRCRAFT CARGO-HANDLING SYSTEM FOR HIGH-FLOOR AIRCRAFT. Rept. for 29 July 58-24 Apr 59 on High Floor Study, Contract AF 33(600)37569. 5 June 59, 118p. Engineering rept. LB-30108; WADC Technical rept. 59-264; AD-216 085.
Order from OTS $2.50 PB 161 294

The purpose of this study is to investigate and design a cargo handling system for the following high-floor aircraft (C-54, C-97, C-118, C-121, KC-135, and the 1920 which is representative of the swing-tail jet transports). This cargo handling system would reduce the loading and off-loading time, thus effectively increasing the utilization of the aircraft. The wide variety of cargo compartment configuration represented by the high floor aircraft were thoroughly analyzed in order to derive a single pallet size which would provide the best utilization of the compartment space. The cargo handling system recommended as a result of the study utilizes rigid, flat pallets, 5 feet by 7 feet in size equipped with web cages for the consolidation and unitization of loads. Ball conveyors at aircraft door entrance provides omni-directional movement of the pallets for proper alignment between the guide rails in the aircraft. Roller conveyors on the floor permit moving the pallet to the proper location in the cargo compartment where quick action locking pins provide the restraint for flight. A self-contained loading capability, jettisoning problems, and application of the system to the Civil Reserve Air Fleet were also studied.

Giravions Dorand (France).
DESIGN STUDY OF THE FEASIBILITY OF FLYING-CRANE TYPE HELICOPTERS INCORPORATING THE JET-FLAP CONTROL SYSTEM. VOLUME I: TEXT, by R. Dorand and S. Tararine. Rept. on Contract DA 91-591-EUC-987, 30 Apr 59, 315p. 87 refs. Rept. no. 1088.
Order from LC mi$11.10, ph$48.60 PB 144 460

The object of this report is to study the feasibility of flying-crane-type helicopters incorporating the new and promising concept of the jet-flap control system, to determine the optimum crane helicopter configuration for carrying 20 to 30 tons of cargo a distance of 10 to 100 nautical miles and to estimate the operational costs of such a machine. The flying-crane helicopter program considered here is as follows: - Payload: 20 to 30 tons at sea level, under standard conditions, 10 to 20 tons under tropical conditions - Range: 10 to 100 nautical miles - Ferry range: 500 to 1500 nautical miles - Cruising speed: not less than 60 Kts - Hovering ceiling: 6000 ft at 95° F. Study of this program leads to the consideration of several design studies each including the jet flap control system.

Giravions Dorand (France).
DESIGN STUDY OF THE FEASIBILITY OF FLYING-CRANE TYPE HELICOPTERS INCORPORATING THE JET-FLAP CONTROL SYSTEM. VOLUME II: FIGURES AND CHARTS, [by R. Dorand and S. Tararine] Rept. on Contract DA 91-591-EUC-987. 30 Apr 59, 122p. Rept. no. 1088.
Order from LC mi$6.30, ph$19.80 PB 144 461

See PB 144 460

Hiller Aircraft Corp., Palo Alto, Calif.
INVESTIGATION OF A RESONANT BURNER CONCEPT, PHASE I, by R. M. Lockwood. Summary rept. on Contract Nonr-2458(00). 1 Dec 58, 50p. 5 refs. Rept. no. ARD-219.
Order from LC mi$3.30, ph$7.80 PB 144 289

A new resonant combustor concept has proceeded to the point of initial evaluation. A shrouded resonant combustor with multiple ejector-type air inlets has been constructed and demonstrated. The main purpose of this research has been to achieve a combustion that can take advantage of the qualities of resonant combustion (a combination of high combustion efficiency with a pressure rise during combustion) without suffering from the air inflow losses characteristic of resonant combustion with increasing airspeed.

Hiller Helicopters, Palo Alto, Calif.
TWO-PLACE OBSERVATION HELICOPTER: PRELIMINARY DESIGN STUDY, by John F. Straubel, ed. Rept. on Contract DA 44-177-tc-421. Aug 57, 136p. Rept. no. 57-76.
Order from LC mi$6.90, ph$21.30 PB 138 540

It is the purpose of this report to provide design and operational suitability evaluations of various specimen configurations and individual components within the Army two-place helicopter concept. The study scope has been limited to consideration of single main rotor --anti-torque rotor, mechanically driven helicopters. It has been the intention in compiling this report that it be usable not only as a supplement to the other study reports, but also as a handbook to which the Army can refer in establishing new configurations which may seem worthy of consideration.

Hiller Helicopters, Palo Alto, Calif.
TWO-PLACE OBSERVATION HELICOPTER: PRELIMINARY DESIGN STUDY. RECOMMENDATIONS. Rept. on Contract DA 44-177-tc-421. Aug 57. 28p. 1 ref. Rept. no. 57-77.
Order from LC mi$2.70, ph$4.80 PB 138 541

The following report provides Hiller Helicopters' recommendation to the Army for a lightweight, two-place helicopter for operations in the 1960-1970 decade. This material is supplementary to the Two-Place Helicopter Preliminary Design Study, which is presented separately in Report 57-76.

Kellett Aircraft Corp., Willow Grove, Pa.
DESIGN STUDY, ARMY TWO-PLACE HELICOPTER, by Arthur Jennings, J. A. Gaidelis and others. Rept. on Contract DA 44-177-tc-416. Aug 57, declassified 28 Apr 58, 216p. KAC rept. no. 124X90-1.
Order from LC mi$9.60, ph$33.30 PB 138 542

Presented in this report are the results of a design study of an Army Two-Place Helicopter which is designed for low-cost, reliability, ease of maintenance, and of smaller configuration size than present reconnaissance helicopters.

Nagler Helicopter Co., Glen Cove, N. Y.
PRELIMINARY DESIGN STUDY OF ARMY TWO-PLACE HELICOPTER, by Eugene K. Liberatore. Final summary rept. on Contract DA 44-177-tc-418. 6 Sep 57, 278p. 16 refs. Nagler rept. 190-F-1.
Order from LC mi$11.10, ph$42.60 PB 138 545

Submitted here is the preliminary study of a two place observation helicopter suitable for Army operations. The principle feature of the configuration is the powerplant and drive system in which the engine and crankcase are free to turn in opposite directions. The performance given in the Statement of Work is substantially satisfied with a helicopter of 1750 lbs. gross weight using a 180 HP Lycoming 0-360 Engine. A turbine driven version would have a normal gross weight of about 1500 lbs.

Chemical Engineering

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE PREPARATION OF FAR INFRARED FILTERS POTENTIALLY USEFUL FOR THE DETECTION AND ANALYSIS OF COMPOUNDS CONTAINING THE PHOSPHORUS-OXYGEN-ALKYL LINKAGE, by Arnold Prostak. 1 Oct 58, 10p. 10 refs. CWL Technical memo. 32-35.
Order from LC mi$1.80, ph$1.80 PB 144 035

Stable transmission filters have been prepared from talc and Fluorothene for the 10 micron infrared region with a half bandwidth of 0.9 micron and a peak transmission of 77%. These filters are applicable to a

LOPAIR device for detecting compounds containing the phosphorus-oxygen-alkyl linkage. Replacing the present monochromator with filters should result in greater simplicity, reduction of cost and weight, and perhaps longer range.

Badger, W. L., Associates, Inc., Ann Arbor, Mich.
OPERATION OF PILOT PLANT LTV EVAPORATOR AT WRIGHTSVILLE BEACH, NORTH CAROLINA.
Rept. for Nov 57-31 May 59. 30 July 59, 98p. 6 refs. Rept. no. 452; Office of Saline Water Research and Development Progress rept. no. 26.
Order from OTS $2.75 PB 161 290

The primary objective in the development of the W. L. Badger Long Tube Vertical Multiple Effect Evaporator for saline water conversion is to minimize the ultimate cost of producing potable water. To accomplish the primary objective, it is necessary to (1) prevent formation of scale on heating surfaces, and (2) minimize corrosion to permit use of inexpensive materials of construction. The work done leading to this report was guided in the direction of accomplishing the two secondary objectives. The pilot plant was built as a single effect Long Tube Vertical Evaporator supplemented by two Forced Circulation Evaporators. To insure results which could be translated to commercial installations, the system was built with sufficient flexibility to permit operation under the conditions which would exist in any effect of a twelve effect system including one stage of thermocompression. The experimental work was divided into four major classifications: (1) Rising film heat transfer, (2) Falling film heat transfer studies, (3) Scale prevention experiments, (4) Corrosion investigation.

[Massachusetts Inst. of Tech., Cambridge].
FILTRATION OF AEROSOLS, by D. F. Jergensen and R. P. Whitney. 9 Oct 42, declassified 27 Sep 58, 52p. 3 refs. Memorandum rept. M. I. T. - M. R. no. 11.
Order from LC mi$3.60, ph$9.30 PB 143 906

Some of the fundamental factors involved in aerosol filtration have been investigated; principally air velocity, size of fiber, degree of compression of filter pad, type of material, and charge on the smoke particles.

Polytechnic Inst. of Brooklyn, N. Y.
DEVELOPMENT OF EMERGENCY DESALTING KIT, by H. P. Gregor, H. Jacobson and R. Dogan. Final rept. on Contract NObsr-65586. 26 Feb 57, 43p. AD-140 611.
Order from LC mi$3.30, ph$7.80 PB 138 487

Work was undertaken to design, develop, and furnish 2 prototype models of portable desalting unit capable of producing potable water from live sea water by a single pass through an ion-exchange film. Sulfonic cation-exchange membranes were prepared by the interpolymer solution technique. Concentration potentials were 15.5 mv in 0.2 M solutions, compared to a theoretical maximum of 16.1 mv; resistances ranged upwards from about 5 ohm sq cm. Films were incorporated onto microfilter porcelain disks. To prevent the membranes from swelling, several techniques designed to cross-link the matrix were investigated; physical and electrochemical properties were not improved. Interpolymer membranes were subjected to aqueous solutions under a pressure head of about 2000 psi; the films were essentially impervious to water. Water-transport and salt-rejection studies as a function of time were performed. Salt solutions of varying concentrations were opposed to sugar solutions of varying concentrations, and significant desalting was found. Interpolymer membranes were used to separate dry fructose from 0.59 M (3.45%) NaCl solutions. Resulting fructose solutions (via osmosis) of 60-70% H_2O (by weight and of 0.4-0.8% NaCl were obtained. Prototype desalting bags for demonstration purposes were fabricated. This method for desalting sea water will not only provide potable water, but also a food substance. Assuming a 65% water solution of fructose and water, a volume ratio (volume of H_2O/volume of fructose) of 3.97 and an analogous weight ratio of 2.47 is obtainable.

Civil Engineering

Bureau of Yards and Docks, Washington, D. C.
HOUSING AND SUBSISTENCE FACILITIES.
15 May 54, 85p. 12 refs. Technical Pub. NAVDOCKS TP-Pw-23.
Order from LC mi$4.80, ph$13.80 PB 144 109

This publication is intended primarily as a guide for civilian and military personnel responsible for planning, designing, and constructing housing and subsistence facilities at naval shore activities. Reference is occasionally made to maintenance features. Part A presents the general authority under which this Bureau provides public works and public utilities, including housing and subsistence facilities. Part B deals with family quarters, including married officers' quarters, married enlisted men's quarters, and married civilian personnel quarters. Part C data cover planning and architectural requirements for bachelor officers' quarters, male and female. Part D gives data for enlisted men's barracks, enlisted women's barracks, and subsistence facilities. Part E describes commissary stores, including organization and architectural requirements. Part F presents the planning and layout of bread and pastry bakeries, also bread-baking and bread-handling equipment. Part G describes the location and design of laundries, including functional planning and equipment.

Land Locomotion Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
PREDICTION OF "WES CONE INDEX" BY MEANS OF A STRESS-STRAIN FUNCTION OF SOILS, by Zoltan Janosi. Feb 59, 28p. 2 refs. Rept. no. 46.
Order from LC mi$2.70, ph$4.80 PB 144 410

The "cone index" developed by the Waterways Experiment Station (WES) of the Corps of Engineers for the purpose of estimating soil trafficability may be calcu-

lated with acceptable accuracy from the appropriate empirically defined stress-strain function of the given terrain. Methods for the determination of that function and the equations which express it were developed by the Land Locomotion Laboratory and successfully used in the prediction of the "cone index."

Stanford U., Calif.
INVESTIGATION OF SHEAR WALLS. PART 12: STUDIES OF REINFORCED CONCRETE SHEAR WALL ASSEMBLIES, by Jack R. Benjamin and Harry A. Williams. Technical rept. no. 10 on Contract DA DA 49-129-eng-193. Dec 56, 224p. 11 refs. AFSWP 891; AD-145 422.
Order from LC mi$9.90, ph$34.80 PB 138 121

Models tested were one and two story assemblies containing two or three shear walls connected by diaphragms in all cases. Some assemblies contained front and back face walls also. The distribution of load in three wall structures is largely dependent on the rigidity of the foundation structure and the supporting soil.

Stanford U., Calif.
INVESTIGATION OF SHEAR WALLS. PART 13: FINAL REPORT-SUMMARY OF RESULTS OF STUDY OF REINFORCED CONCRETE AND BRICK WALLED BENTS UNDER STATIC SHEAR LOADING, by Jack R. Benjamin and Harry A. Williams. Technical rept. no. 11, 31 Mar 51-31 Dec 56, on Contract DA 49-129-eng-193. Dec 56, 40p. 12 refs. AFSWP 892; AD-145 423.
Order from LC mi$3.00, ph$6.30 PB 138 115

Methods of predicting the behavior of one-story reinforced concrete and brick shear walls are given. Various parameters affecting the problem are reviewed briefly. The investigation was restricted to static loading. (See also PB 138 121)

Electrical and Electronic Engineering

Aero Geo Astro Corp., Alexandria, Va.
AN INVESTIGATION OF POLARIZATION RESPONSE FOR RADIATION OVER A FINITE CONDUCTING PLANE, by Duncan M. Bowie. Scientific rept. no. 1 on Contract AF 19(604)5481. 19 Oct 59, 49p. 5 refs. AFCRC-TN-59-772.
Order from LC mi$3.30, ph$7.80 PB 143 996

This report describes an investigation of the radiation patterns obtained from a feed located close to a ground plane. It considers a new technique for increasing the available power in a plane containing the finite ground plane. In particular, the well-known limitations of the horizontally polarized signal were investigated and a technique was developed for enhancing this signal. Improved horizontal polarization response was obtained by using a grounded dielectric foam structure with thickness of the order of a few wavelengths. This structure was extended over the ground plane to provide improvement in horizontal polarization response. Data is given in terms of beam position for a variety of foam dielectric configurations. With a sufficient amount of foam, pattern characteristics are obtained approximately equal to those of the feed in free space. Vertical polarization data regarding beam position is also provided and an Appendix contains the detailed radiation patterns for both polarizations.

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
DESIGN CONSIDERATIONS OF A STEADY DC MAGNETOHYDRODYNAMIC ELECTRICAL POWER GENERATOR, by George W. Sutton. Rept. on Contract AF 04(647)269. 15 Sep 59, 50p. 8 refs. Technical Information Series R59SD432.
Order from LC mi$3.30, ph$7.80 PB 144 200

The design of an mhd generator has been considered, including the length, pressure, magnetic field strength and losses. The geometry chosen is a straight channel of variable cross-section. Only DC power generation is considered utilizing temperatures which may be obtained from conventional thermal sources. Losses due to high exhaust temperature, ohmic heating, wall cooling, magnet power and end effects are amenable to control. As far as magnet power is concerned, indications are that these losses are approximately constant. The implication is that the mhd generator should be large, and formulae are given to determine the various losses for different size units. Since the exhaust gases from the mhd generator are very hot, these gases must be utilized further to obtain a reasonable overall thermal effeciency.

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
ELECTRICAL AND PRESSURE LOSSES IN A MAGNETOHYDRODYNAMIC CHANNEL DUE TO END CURRENT LOOPS, by George W. Sutton. Rept. on Contract AF 04(647)269. 22 July 59, 47p. Technical Information Series R59SD431.
Order from LC mi$3.30, ph$7.80 PB 144 189

The problem of end losses in a magnetohydrodynamic flow has been studied for incompressible inviscid flow in a rectangular channel. Termination of the magnetic field at the ends of the electrodes leads to electrical losses which increase with decreasing aspect ratio of the electrode section ot the channel. The losses are also increased with increasing values of the generator coefficient. These electrical losses can be corrected by extensions of the magnetic field beyond the electrode region, but these corrections adversely affect the net pressure change through the device.

Air Force Cambridge Research Center, Bedford, Mass.
SURVEY OF RECENT GEOMETRIC-ANALYTIC WORK ON IMPEDANCE, POWER, AND NOISE TRANSFORMATIONS, by E. Folke Bolinder. May 59, 22p. 50 refs. AFCRC-TR-59-146; AD-215 821.
Order from LC mi$2.70, ph$4.80 PB 144 431

A survey is made of recent geometric-analytic work on impedance, power, and noise transformations. Three basic research publications treating impedance, power, and noise transformations through bilateral 2-port networks are briefly outlined. Analytically, the transformations consist in conformal, projective, and affine transformations. Geometrically, they are performed in the complex plane, in the Cayley-Klein models of 2- and 3-dimensional hyperbolic space, and in the Minkowski model of 4-dimensional Lorentz space.

Air Force Missile Test Center, Patrick AFB, Fla.
MAGNETIC TAPE COPY STATION, by C. R. Scott and W. H. Bulter. 12 Aug 58, 15p. AFMTC-TR-58-18; AD-157 101.
Order from LC mi$2.40, ph$3.30 PB 144 318

This paper outlines in a detailed manner the operation of the Magnetic Tape Copy Station presently operational at the Air Force Missile Test Center.

American Electronic Labs., Inc., Philadelphia, Pa.
OMNIDIRECTIONAL ANTENNA SYSTEM AS-631 (XE-2)/U, by Milton Nussbaum. Final rept. for 1 July 55-1 Nov 56 on Contract DA 36-039-sc-64679. [1956] 91p. 5 refs. AD-133 954.
Order from LC mi$5.40, ph$15.30 PB 137 518

Efforts to develop a transportable antenna system capable of receiving vertically polarized electromagnetic energy throughout the 20- to 120-mc range resulted in the development and construction of the AS-631(XE-2)/U system. A rod-type discone antenna, mounted on a telescoping mast, was developed to meet the electrical and mechanical requirements. The frequency coverage was accomplished by splitting the range into low (20 to 62 mc) and high (62 to 120 mc) bands for correlation with the TLR-1 receiving system. Each band requires a separate disk, but both bands have common cone rods. The high-band discone will operate on top of the telescoping mast (24 ft above the ground), but the optimum operating position for the low-band antenna is as close to the ground as possible. The high-band antenna is useful up to 180 mc. The telescoping mast is adaptable for mounting the discone antenna.

Army Signal [Research and Development Lab.] Fort Monmouth, N. J
DESIGN FOR EASE OF MAINTENANCE, by Samuel J. Lanzalotti. 17 July 57, 25p. Technical memo. no. M-1905; AD-144 088.
Order from LC mi$2.70, ph$4.80 PB 138 095

The problems associated with the maintenance of electronic equipment are discussed to indicate some of the difficulties correctable by proper design. Design for ease of maintenance is concerned with keeping the equipment in operation with a minimum down time alloted per malfunction and with designing equipment capable of being maintained by personnel with training equal to that normally required to operate the equipment. Discussions are included on the designers responsibility, specification and designing for maintainability, and the principles of design for ease of maintenance.

Bell Telephone Labs., Inc., Whippany, N. J.
AN ULTRA-PRECISE STANDARD OF FREQUENCY, by A. W. Warner. Interim rept. no. 9, 13 July 58-9 Jan 59, on Contract DA 36-039-sc-73078. 23 Jan 59, 29p. 2 refs. Rept. no. 27480-H.
Order from LC mi$2.70, ph$4.80 PB 144 300

This report includes a discussion of a new phase of the work, the development of a ruggedized high-precision crystal unit capable of maintaining 1 pp 10^9 in an environment incumbent to missile-borne use, and the continuation of work leading to an improved ground station oscillator. One preliminary model of the 5-mc missile crystal unit has been made to obtain dimensional data. Two models of the 2.5-mc ground station crystal unit have been made using thermo-compression bonding, and testing has begun. Vibration equipment, and a centrifuge and oven have been obtained to test the missile crystal unit. A welder and an ultrasonic cleaner have been obtained for use in crystal unit fabrication. An experimental 5-mc transistor oscillator has been designed and built. An improved 2.5-mc three-stage oscillator has been constructed. (See also PB 142 641)

Birmingham U. (Gt. Brit.).
CHARACTER RECOGNITION. Annual rept. for period ending 30 Sep 59 on Contract DA 91-508-EUC-361. [1959] 23p. 7 refs.
Order from LC mi$2.70, ph$4.80 PB 144 238

The five-unit telegraph code is a non redundant code, in as far as all the possible combinations of mark and space digits, except five spaces, are used, and further consideration of the question of correlation detection applied to the recognition of the characters of a non-redundant code showed that there was no advantage over 'digit-by-digit' recognition. Tests were carried out on the recognition of signals from an 'alphabet' of the ten numerals 0 to 9 in a double difference (i.e. redundant) five-unit code using both correlation detection and normal teleprinter recognition. The former showed a considerable improvement in error rate. The amount of extra noise which can be tolerated using the correlation system varied from about 3db at low error rate to 6db at an error rate of about 30%. In the double difference code used each character is different from any other character in at least two and sometimes in four digits. Obviously the probability of a character being received as one different in four digits is less than that of it being received as one different in only two digits and the frequencies of occurrence of both these types of error were noted. The ratio of double difference to quadruple difference error was 263 to 1.

Collins Radio Co., Cedar Rapids, Iowa.
TEST SET, RADIO AN/ARM-22(XN-1) by K. L. Fletcher. Rept. on Contract NOas-52-623-c. 1 Feb 57, 27p. Rept. no. CER-526; AD-127 239.
Order from LC mi$2.70, ph$4.80 PB 144 378

The purpose of work on Radio Test Set AN/ARM-22(XN-1) was to design and develop suitable test equipment for maintenance of Radio Set AN/ARN-21 and associated equipment. The equipment includes six major units as shown in figure 1. Together these units provide complete test facilities for airborne

TACAN equipment. Included are provisions for simulating either the r-f signals received from an AN/URN-3 surface beacon or the corresponding video signals. Also included are channel selection facilities, complete instrumentation, r-f power-measuring circuitry, and other functions necessary for testing of all military airborne TACAN equipment.

Courtney and Co., Philadelphia, Pa.
THE CONTROL OF SPECULAR REFLECTIONS FROM BRIGHT TUBE RADAR DISPLAYS, by Kenneth W. Colman, Douglas Courtney and others. Technical rept. on Contract Nonr-2346(00). 15 Nov 58, 25p. 13 refs. Rept. no 23.
Order from LC mi$2.70, ph$4.80 PB 144 316

Diamond Ordnance Fuze Labs., Washington, D. C.
ANALYSIS OF POWER DISSIPATION IN A TWO-TRANSISTOR FLIP-FLOP, by Philip Emile, Jr. 14 Aug 59, 11p. 2 refs. DOFL rept. TR-746; AD-226 075.
Order from LC mi$2.40, ph$3.30 PB 144 227

The design of an Eccles-Jordan 2-transistor flip-flop is completely determined if one specifies: the output power, V_O^2/R_{EXT}, required in each of 2 symmetrical loads (R_{EXT}); the ratio, K of the output voltage to the collector supply voltage ($K = V_O/V_{CC}$); and the minimum β, β/S, of the transistor. An expression for the power dissipation in the collector resistors of the flip-flop is derived in terms of the above parameters. It is found that the power dissipation varies inversely with β/S. It is further shown that even for $\beta/S \rightarrow$ and K taken at its optimum value that the minimum power dissipated in the circuit is at least 4.8 times the power dissipated in the load ($4.8\ V_O^2 R_{EXT}$). This gives a maximum efficiency (Power Out/Power In = 1/5.8 x 100 percent) of 17.3 percent. Curves of maximum efficiency, optimum K and power dissipation versus β/S are included.

Diamond Ordnance Fuze Labs., Washington, D. C.
FLAT ARCHIMEDEAN SPIRAL ANTENNA: PRINCIPLES AND APPLICATIONS, by J. A. Kaiser. 15 Aug 59, 38p. 14 refs. TR-726.
Order from LC mi$3.00, ph$6.30 PB 144 228

A pair of equally excited but oppositely sensed Archimedean two-wire spirals situated close to one another in the same plane - a doublet - is used to generate a linearly polarized field in which the direction of polarization and phase are controlled or varied independently by rotation of the spiral radiators. An array of these doublets can be made to scan by rotation of the several spiral elements; an eight-doublet array which was made to scan over an 83-degree sector with small amplitude variation is discussed. A doublet fed from a ring network can be employed as a polarization diversity circuit. A virtual doublet is achieved by placing a single spiral in a right-angle trough. A preliminary scanning array comprising four spirals in a trough was made to scan ±36 degrees. The possibility of using a parasitic spiral in conjunction with a driven spiral for obtaining linear polarization of variable direction and phase is indicated. Also, a brief simplified analysis of the two-wire Archimedean spiral is presented, which leads to the concept of higher-order modes of radiation.

Diamond Ordnance Fuze Labs., Washington, D. C.
FURTHER EXTENSIONS OF LOOP ANTENNA THEORY, by J. Herman. 15 July 59, 52p. 12 refs. TR-756.
Order from LC mi$3.60, ph$9.30 PB 144 226

A complete mathematical solution for the thin wire loop antenna, and the subsequent development of the principle of "mode selection and suppression" using inserted distributed and/or lumped internal impedances have been previously reported in DOFL Reports TR-462 and TR-600. The original solution was expressed in the form of wave families, consisting of one TE family and two TM families. In the present report, the two TM families are consolidated into one, and the general solutions for currents, impedances and fields revised accordingly. The solutions are then extended to incorporate the effect of multiple feed points with or without arbitrary phase delays. The problem of a loop with a solid dielectric core is then reformulated, and extended to the case of a hollow spherical dielectric core inclosing a spherical conducting core. It is shown that the basic loop element theory can be used to form the solution to an array of parallel, coaxial, unequally spaced, and unequal size loops, driven or parasitic. The results lead to a high degree of control over radiation coverage, and indicate further possible advantages, such as electronic beam scanning. The use of the theory developed can aid in antenna design to a great extent. The possibilities have not been completely explored. Further work will probably prove quite profitable.

Diamond Ordnance Fuze Labs., Washington, D. C.
LOW-ALTITUDE FM ALTIMETER, by Philip W. Boesch and Kermit E. Hardinger. 10 Aug 59, 23p. 5 refs. Technical rept. TR-740; AD-225 570.
Order from LC mi$2.70, ph$4.80 PB 144 170

With the recent emphasis on aircraft navigation safety, effort has been directed toward developing an altimeter capable of providing adequate altitude information for blind landings. Application of fuzing principles invented at DOFL has led to a radio altimeter which accurately (5 percent) measures distances from 5 ft to several thousand. This altimeter has been designed to furnish the pilot altitude information accurate enough throughout flareout and landing to enable him to make a safe instrument landing. The altimeter could also be adapted to supply this information to a computer for an automatic landing system. This is a signal-seeking altimeter that searches in frequency until a signal is found, then locks on and tracks it. If the signal fades out or is otherwise lost, the system will resume searching until recaptured by the signal. A warning device indicates loss of signal. The basic FM system uses jittered (nonperiodic) triangular modulation of a reflex klystron. This produces a jittered FM transmitted signal, which, when mixed with the return signal, produces an instantaneous difference frequency proportional to the distance from the ground. The aperiodicity eliminates critical distance and range ambiguities. The altimeter has been tested with a moving corner-reflector target out to several hundred

feet and flight tested in a helicopter to 1000 ft. with good results.

Eagle-Picher Co., Joplin, Mo.
SERVICES, FACILITIES AND MATERIALS TO CONDUCT INVESTIGATIONS LEADING TO THE DEVELOPMENT OF RESERVE TYPE BATTERIES (LOW TEMPERATURE). Final rept. on Contract DA 36-039-sc-72413. 7 July 57, 25p. AD-145 981.
Order from LC mi$2.70, ph$4.80 PB 138 421

A completely potted, water-activated battery was developed which meets the physical requirements of the BA-2270/U. The capacity of the battery at -40°F under high-wind-velocity conditions is limited to about 2 hr for the A unit and 4 hr on the B batteries. From 4 to 5 hr of life is possible under carefully controlled conditions. The optimum temperature for the battery is 165°F; the system was considered too critical for general usage. Water-activated batteries liberate heat at rates proportional to their internal temperature as well as the current they are delivering. The batteries can fail by spiraling temperatures which finally boil the unit dry or by cooling which causes a degeneration of chemical action and allows the units to freeze. The temperature band in which a successful battery can be built becomes more narrow with a required longer operation.

Electrical Engineering Research Lab., U. of Texas. Austin.
AN INVESTIGATION OF THE FEASIBILITY OF USING THE BROOKS ANTENNA SYSTEM AT L-BAND, by A. P. Deam, F. E. Brooks, Jr. and A. N. McQuown. Rept. on Contract NObsr-64126. 30 Nov 54, declassified 5 July 57, 65p. 2 refs. Rept. no. 8-02; AD-72 760.
Order from LC mi$3.90, ph$10.80 PB 137 808

This report concerns the adaptation of the Brooks Antenna System as a height finding radar in connection with the AN/TPS-1D radar. The first phase of this contract dealt with studying the feasibility of the system in view of the problems involved. Signal strengths versus elevation of a transmitter at a frequency of 1175 mc are reported over various types of terrain. From these height-gain curves estimates of the performance of a double interferometer used as a height finder were made. The results are presented in the form of distribution curves showing the percentage of time a particular accuracy is reached. The results show that with an interfering signal whose magnitude is 14 db below that of the direct ray the measured elevation angle will be in error by less than 0.2° for 25% of the time. A method is proposed, utilizing a balanced modulator principle, for developing frequency shifts that are equivalent to those normally produced by a continuously varying phase shifter. It is felt that the results of this first phase of the program are encouraging and that work should proceed to the second phase, the construction of a working model of the system.

Electronic [Tech. Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
TECHNIQUES FOR APPLICATION OF ELECTRON TUBES IN MILITARY EQUIPMENT (TUBE TYPES OTHER THAN RECEIVING TUBES) by Rex S. Whitlock. Compiled into book form by McGraw-Hill Book Co. under Contract AF 33(616)3551. Dec 58, 206p. 13 refs. WADC Technical rept. 58-446, Vol. I; AD-205 363.
Order from OTS $3.50 PB 151 979

This report is part of a series of reports covering the application of electron tubes in military electronic equipment. The information contained in the reports is presented as a guide to the engineer so that he can more fully utilize electron tubes with the greatest degree of reliability. The first report of this series, WADC TR 55-1 (PB 111 644R), dated October 1957, covers receiving type tubes and also gives general information on tube properties, ratings, characteristics, and application. This manual is Volume 1 of the second report, which covers microwave and special purpose tubes. Volume 1 contains general information about pulsed magnetrons, diode rectifiers, thyratrons, transmitting triodes, and transmitting tetrodes. Special data are also given for certain tube types.

Electronic Tech. Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
TECHNIQUES FOR APPLICATION OF ELECTRON TUBES IN MILITARY EQUIPMENT (TUBE TYPES OTHER THAN RECEIVING TUBES) by Rex S. Whitlock. Compiled into book form by McGraw-Hill Book Co. under Contract AF 33(616)3551. June 59, 189p. 9 refs. WADC Technical rept. 58-446, Vol. II; AD-215 429.
Order from OTS $3.00 PB 161 088

This manual covers microwave and special purpose tubes. This volume contains general information about twin tetrodes, vacuum rectifiers, grid-controlled rectifiers, transmitting clipper diodes, gas switching tubes, cathode ray tubes, klystrons, and multiplier phototubes. Specific data are also given for certain tube types. (See also PB 151 979)

Electronics Research Lab., U. of California, Berkeley.
ELECTRON AND PLASMA BEAM DYNAMICS, by A. J. Litchenberg, D. H. Sloan and others. Scientific rept. no. 3 (Interim annual rept.) for 1958-1959 on Contract AF 19(604)2270. 15 June 59, 57p. 18 refs. IER Series no. 60, issue no. 238; AFCRC-TN-59-565.
Order from LC mi$3.60, ph$9.30 PB 144 498

Studies cover the following: Vacuum tubes; Cross-field gaseous tubes; Parallel-field gaseous tubes; Semiconductor properties of ionized gas; and Plasma as a means of microwave amplification. (See also PB 137 474)

Erie Resistor Corp., State College, Pa.
ENERGY STORAGE CAPACITATORS, HIGH DIELECTRIC CONSTANT, by Lawrence J. Ruffner. Interim development rept. no. 2, 13 July-13 Oct 59, on Contract NObs-77554. [1959] 102p.
Order from LC mi$5.70, ph$16.80 PB 144 254

Developing a ceramic composition suitable for fabrication of finished capacitors. Barium titanate-magnesium fluoride compositions have been satisfactorily reproduced with some improvement in dielectric constant.

General Electric Microwave Lab., Palo Alto, Calif.
COMPUTER APPLICATIONS, by V. Met and M. P. Forrer. Quarterly progress rept. for 1 Aug-30 Sep 58 on Contract Nonr-2127(00). [1958] 3p. Rept. R58ELM 79-3.
Order from LC mi$1.80, ph$1.80 PB 144 446

Efforts were concentrated on the task of putting the assembled recirculative pulse generator into operation. An automatic gain control could be provided, and a six cavity bandpass filter of 600 mc bandwidth and 0.2 db ripple in the passband has been constructed. The match of components in the circuit was perfected to an excellent standard. External gain modulation was also accomplished from a conventional 10 to 50 mc signal generator, corresponding to the desired pulse repetition rate.

General Electric Microwave Lab., Palo Alto, Calif.
COMPUTER APPLICATIONS, by V. Met and M. P. Forrer. Quarterly progress rept. for 1 Oct-31 Dec 58 on Contract Nonr-2127(00). [1958] 13p. 1 ref. Rept. R 59 ELM 79-4.
Order from LC mi$2.40, ph$3.30 PB 143 986

During the reporting period the regenerative pulse generator with traveling-wave tube expander was put into successful operation. The pulses obtained approach the limits of the resolution of our present test equipment. Thus, having demonstrated the realizability of our suggested scheme, the effort on the contract was temporarily diminished with the contract funds 75 per cent expended. It is felt that a three-month extension of the contract would give us time to evaluate and perfect our present results, which are highly encouraging. (See also PB 139 828)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by James C. Hogg, Jr. Progress rept. no. 1, 15 Mar-15 June 54, on Contract DA 36-039-sc-56730. [1954] 19p. 9 refs.
Order from LC mi$2.40, ph$3.30 PB 138 476

Circuit studies indicate that modification of the present C.I. Meter circuit to incorporate a two-stage amplifier should give reliable operation at frequencies above 150 mc with crystals having resonant resistances equal to or less than 200 ohms. An experimental Impedance-Inverting Pierce Oscillator has been constructed and tested for applicability as a high-frequency crystal test set.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by James C. Hogg, Jr. and Douglas W. Robertson. Progress rept. no. 2, 15 June-15 Sep 54, on Contract DA 36-039-sc-56730. [1954] 29p. 3 refs.
Order from LC mi$2.70, ph$4.80 PB 138 477

A two-stage version of the C. I. Meter circuit has been constructed and satisfactory operation obtained at 132 mc with substitution resistors having values well in excess of 200 ohms. Phase-detection system and a bridge system for measuring the resonant frequencies of crystals have been investigated. (See also PB 138 476)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by William B. Wrigley and Douglas W. Robertson. Progress rept. no. 3, 15 Sep-15 Dec 54, on Contract DA 36-039-sc-56730. [1954] 29p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 138 478

A study of the VHF impedance characteristics of low-value resistors with particular attention to the development of low-phase-angle potentiometers and other components to be utilized in various bridge configurations contemplated for use in future C. I. Meters. A two-stage line-coupled oscillator circuit has been developed. (See also PB 138 477)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by William B. Wrigley and Douglas W. Robertson. Progress rept. no. 4, 15 Dec 54-15 Mar 55, on Contract DA 36-039-sc-56730. [1955] 36p. 1 ref.
Order from LC mi$3.00, ph$6.30 PB 138 479

Development of a VHF rheostat to cover a resistance range of 10 to 200 ohms with an acceptably low phase angle from 75 to 200 mc. The bridge system of crystal parameter measurement is very promising. (See also PB 138 478)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by William B. Wrigley, Douglas W. Robertson, and Thomas R. Scott, Jr. Progress rept. no. 5, 15 Mar-15 June 55, on Contract DA 36-039-sc-56730. [1955] 28p. 6 refs.
Order from LC mi$2.70, ph$4.80 PB 138 480

Preliminary studies have been made to determine the effect of drive on the parameters ot high-frequency overtone crystals. The frequency and R_e deviations experienced make evident the necessity of specifying the drive or power dissipation in the proposed high-frequency C. I. Meter. (See also PB 138 479)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by William B. Wrigley, Douglas W. Robertson, and Thomas R. Scott, Jr. Progress rept. no. 6, 15 June-15 Sep 55, on Contract DA 36-039-sc-56730. [1955] 23p.
Order from LC mi$2.70, ph$4.80 PB 138 481

Several sets of VHF rheostats have been constructed. Metals of the platinum family are undergoing tests as possible substitutes for nickel. An analysis of a practical method for determining all the equivalent electrical parameters of an active quartz crystal. (See also PB 138 480)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by William B. Wrigley, Douglas W. Robertson, and Thomas R. Scott, Jr. Progress rept. no. 7, 15 Sep-15 Dec 55, on Contract DA 36-039-sc-56730. [1955] 23p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 138 482

Additional measurements of the harmonic distortion present in the Two-Tube Developmental C. I. Meter. A study of several methods of eliminating or reducing the harmonic content of the companion oscillator. (See also PB 138 481)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by Douglas W. Robertson, Thomas R. Scott, and William B. Wrigley. Final rept. on Contract DA 36-039-sc-56730. 31 May 56, 114p. 15 refs.
Order from LC mi$6.00, ph$18.30 PB 138 483

Contains resume of work in seven previous quarterly progress reports. The final model of the developmental VHF crystal consists of a combination of three basic developmental devices which have been designated as the VHF Rheostat, the Crystal Parameter Bridge and the Developmental CI Meter. A VHF rheostat minimizes reactive effects and, being variable, eliminates the necessity of interpolation. Several alternate bridge arrangements and additional VHF oscillator configurations are also included. (See also PB 138 482)

Hughes Aircraft Co., Culver City, Calif.
MAXIMALLY FLAT AND QUASI-SMOOTH SECTOR BEAMS, by A. Ksienski. Scientific rept. no. 3508/2 on Contract AF 19(604)3508. July 59, 38p. AFCRC-TN-59-581.
Order from LC mi$3.00, ph$6.30 PB 143 975

Methods for the synthesis of sector beams are presented and illustrated with examples. First a perfectly smooth and square beam, the equivalent of the maximally flat transfer function of network theory, is discussed. It is then shown that realization of such beams by means of relatively short arrays is feasible when a certain amount of oscillation is permissible. An alternative method of obtaining almost equal ripple sector beams is also presented. In this quite general method, the desired beam shapes are synthesized by derivation from elementary optimum patterns.

[Kuthe Labs., Inc., Newark, N. J.].
INDUSTRIAL PREPAREDNESS STUDY ON HYDROGEN THYRATHRON TUBES TYPE VC1257, by A. E. Gordon. Quarterly progress rept. no. 6, 1 Oct-31 Dec 57 on Contract DA 36-039-sc-70288. [1958] 10p. AD-218 438.
Order from LC mi$1.80, ph$1.80 PB 138 097

Following successful life tests, production of a revised new design tube was initiated. An excellent yield was obtained and additional life tests were satisfactory. Ten tubes were selected for qualification approval tests and delivery on the contract. (See also PB 132 080)

Lincoln Lab., Mass. Inst. of Tech., Cambridge.
THE AUTOMATIC DESIGN OF LOGICAL NETWORKS, by T. C. Bartee. Rept. on Contract AF 19(122)458. 3 Dec 58, 27p. 9 refs. Technical rept. no. 191; AD-207 170.
Order from LC mi$2.70, ph$4.80 PB 143 826

The operation of a logical network can be described by means of a set of Boolean expressions which represent, in symbolic form, the relationship between the inputs and outputs of the network. As the number of inputs and outputs to the network increases, however, the complexity of these equations increases significantly and the amount of calculation required to solve certain problems becomes prohibitive. In order to facilitate the design of large networks, a set of computer programs has been prepared which generates the expressions that describe the input-output relationships for given problems, and then automatically minimizes these expressions, presenting the logical designer with a set of expressions which can be used to design the required network most efficiently. This design technique makes possible the construction of logical networks which perform such functions as sine, arc sine and square root. When these networks are used as a part of the arithmetic element of a digital computer, these functions may be yielded by a single instruction, significantly reducing the time required to solve certain problems. The latter section of this report describes a sine instruction which replaces an angle with the sine of that angle, in less than 10 μsec.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
DIGITAL RATE SYNTHESIS FOR FREQUENCY MEASUREMENT AND CONTROL, by T. J. Rey. Rept. on Contract AF 19(122)458. 30 Oct 58, 17p. 5 refs. Technical rept. no. 188; AD-205 596.
Order from LC mi$2.40, ph$3.30 PB 144 224

Digital rate synthesis is a transformation of harmonic synthesis (beat methods) from the frequency to the time domain; the synthesis of harmonics is replaced by pulse techniques. The signal whose period is to be measured or controlled is in the form of a pulse train

that has the repetition rate X. A single reference source drives a rate generator which consists of one or more dividing stages in fixed cascade; the output of the generator is a sequence of nonuniformly spaced pulses whose average repetition rate AS is known from the independently controllable connection between the individual stages and their output bus. A rate difference detector compares the rates X and AS. The smoothed detector output has the proper sign and serves to indicate the magnitude of the difference or to reduce the difference in a closed loop, for example, by controlling a tuning motor. The range of direct operation is limited by pulse techniques, but digital and harmonic synthesis can be combined with division and with phase-lock methods to stabilize an oscillator over a practically unlimited band of frequencies, the precision and purity approaching that of the reference source.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
EFFECTS OF THE FILTER IN OSCILLATOR SYNCHRONIZATION, by T. J. Rey. Rept. on Contract AF 19(122)458. 14 May 58, 21p. 13 refs. Technical rept. no. 181; AD-133 854.
Order from LC mi$2.70, ph$4.80 PB 144 301

Automatic phase control (APC) systems with sinusoidal reference are analyzed; expressions are presented for the stability and the noise bandwidth at lock. The limit of the pull-in range is determined, and the result is in good agreement with experiment.

Litton Industries, College Park. Md.
SURFACE WAVE ANTENNA STUDY, by Murray Hoffman. Final rept. on Contract AF 19(604)1551. [1959] 95p. 14 refs. AFCRC-TR-57-188; AD-133 637.
Order from LC mi$5.40, ph$15.30 PB 138 427

The basic array parameters useful to the antenna designer were investigated during the study. These included relative slot excitation, ground plane current distribution, control of phase, a study of the normalized impedance of the slots, the radiation efficiency of the antenna, and the development of production techniques. The various methods for launching the wave onto the ground plane were not covered in the study. Instead, a horn launcher similar to one used by King was employed to couple to the mode and its characteristics were taken into account in the analysis.

Marathon Battery Co., Wausau, Wis.
INDUSTRIAL PREPAREDNESS STUDY ON MAGNESIUM BATTERIES, DRY CELL TYPE BA-270/U-XM, by George H. Schroeder. Quarterly progress rept. no. 10, 8 Mar-7 June 57, on Contract DA 36-039-sc-66081. [1957] 8p. AD-157 210.
Order from LC mi$1.80, ph$1.80 PB 138 105

The basic design of the cell loading machine has been completed. There has been no cell fabrication during this period. (See also PB 129 922)

Marathon Battery Co., Wausau, Wis.
INDUSTRIAL PREPAREDNESS STUDY ON MAGNESIUM BATTERIES, DRY CELL TYPE BA-270/U-XM, by George H. Schroeder. Quarterly progress rept. no. 11, 8 June-7 Sep 57, on Contract DA 36-039-sc-66081. [1957] 8p. AD-157 208.
Order from LC mi$1.80, ph$1.80 PB 138 104

The design of the cell loading equipment has been completed and fabrication is quite well along. (See also PB 138 105)

Marathon Battery Co., Wausau, Wis.
INDUSTRIAL PREPAREDNESS STUDY ON MAGNESIUM BATTERIES, DRY CELL TYPE BA-270/U-XM, by George H. Schroeder. Quarterly progress rept. no. 12, 8 Sep-7 Dec 57, on Contract DA 36-039-sc-66081. [1957] 10p. AD-157 209
Order from LC mi$1.80, ph$1.80 PB 138 106

The machine for loading the lined Mg cups with mix was completed. The machine receives the mix from a hopper, mechanically extrudes it into molds and dies, and subsequently pushes the mix from the mold into a positioned, lined Mg cup. Experiments indicated that the machine will operate satisfactorily with mixes that are too wet to handle on conventional battery fabricating equipment. (See also PB 138 104)

Material Lab., New York Naval Shipyard, Brooklyn.
SPECIFICATION DEVELOPMENT ON "ENAMEL-B" FILM INSULATED HIGH TEMPERATURE MAGNET WIRE, by H. Pinski. Final rept. 19 Mar 59, 17p. Lab. project 4861-F-27, Pt. 8.
Order from LC mi$2.40, ph$3.30 PB 144 124

Evaluation of film insulated magnet wires for information purposes and for further development of specification MIL-W-19583(NAVY).

Michigan U. Research Inst., Ann Arbor.
FINAL REPORT ON CONTRACT AF 19(604)1949, by K. M. Siegel. Rept. for 1 Oct 56-31 July 59. July 59, 7p. 27 refs. Rept. no. 2591-5-F; AFCRC-TR-59-179; AD-225 015.
Order from LC mi$1.80, ph$1.80 PB 144 319

The major effort was the writing of an instruction manual. The purpose of this manual is to tell engineers, mathematicians, and physicists (with only an undergraduate course in electromagnetic theory and the usual undergraduate courses in applied mathematics) how to compute the radar cross sections of aircraft and missiles.

Michigan U. Research Inst., Ann Arbor.
TRANSISTORIZED CIRCUITS FOR USE IN SPACE-RESEARCH INSTRUMENTATION, by L. H. Brace. Instrumentation rept. no. 1 on Contracts DA 20-018-509-ORD-103; AF 19(604)1843; AF 19(604)1948; and DA 36-039-sc-78131. Oct 59, 31p. 5 refs. 2521; 2804; 2597; 2816:1-3-S.
Order from LC mi$3.00, ph$6.30 PB 144 196

The development of various accessory circuits for use in space research instrumentation is described. The

circuits include dc current detectors, voltage-controlled oscillators, voltage generators, timers and dc-dc convertors.

Microwave Associates, Inc., Burlington, Mass.
DEVELOPMENT OF DIODE TYPE 50649B, by R. B. Collins. Quarterly progress rept. no. 3, 1 Dec 58-28 Feb 59, on Contract DA 36-039-sc-78021. [1959] 18p.
Order from LC mi$2.40, ph$3.30 PB 144 154

The final electrical and mechanical design of the diode are discussed. The preparations for the Pilot Production Run are described. (See also PB 142 761)

Microwave Associates, Inc., Burlington, Mass.
VARIABLE CAPACITANCE MICROWAVE DIODE. Quarterly progress rept. no. 1, 1 Nov 58-31 Jan 59, on Contract DA 36-039-sc-78236. [1959] 18p. 1 ref. AD-215 451.
Order from LC mi$2.40, ph$3.30 PB 143 977

Two of the main technical problems to be solved on this contract are electrical evaluation and packaging. In Chapter 1, 9600 Mc impedance measurements are compared with 1000 Mc measurements made at Bell Telephone Laboratories. Agreement is fairly good. The 9600 Mc measurements are generally more sensitive. A hermetically sealed package is required. The soft-glass package used by many manufacturers of low-frequency diodes was tested by fabricating silicon varactors in it. The cutoff frequency of these varactors, measured at 9600 Mc was much lower than for similar varactors made in a ceramic package, according to results given in Chapter 2.

Microwave Engineering Labs., Inc., Palo Alto, Calif.
RESEARCH AND DEVELOPMENT OF A SOLID STATE PARAMAGNETIC MASER, by Roy W. Roberts. Quarterly progress rept. no. 4, 10 Mar-9 June 59, on Contract AF 19(604)4071. 9 July 59, 19p. AFCRC-TN-59-551; AD-226 814.
Order from LC mi$2.40, ph$3.30 PB 143 973

Successful masering has been achieved in several slow-wave structures with typical figures of 10 db gross gain over a 60 mc bandwidth. Both grounded (bandpass) and ungrounded (low pass) combs have been used with the ungrounded comb giving the best results. Non-reciprocal operation has been obtained by use of a poly-crystalline yttrium iron garnet slab on the side of the comb opposite from the ruby giving a typical backward attenuation of 15 db. (See also PB 142 347).

Microwave Lab., Stanford U., Calif.
A PROPOSED MILLIMETER-WAVE GENERATOR, by G. S. Kino. Technical note on Contract AF 49(638)415. Sep 59, 20p. 11 refs. M. L. rept. no. 606; AFCRC-TN-59-890.
Order from LC mi$2.40, ph$3.30 PB 143 995

A millimeter-wave generator, using a waveguide filled with a plasma of uniform cross-sectional density, but with an axial density variation of the form $\rho_0(1+\alpha \sin \gamma z)$, is discussed. It is shown, by solving the wave equation for the system, that slow-wave space harmonics, although usually of small amplitude, can have the property that their electric fields are maximum at the center of the guide and minimum at its walls. The design of a possible 1-mm backward-wave oscillator operating at 2.5 kv with approximately 12 ma starting current is dealt with. This design is postulated on the assumption that the so-called Langmuir "electrostatic sound waves" or similar modes may be used to set up the necessary density variation in the plasma.

Microwave Lab., Stanford U., Calif.
RESEARCH IN MICROWAVE TUBES. Scientific status rept. no. 9 (Final), 1 June 56-30 Sep 58, on Contract Nonr-225(26); Continuation of Contract DA 36-039-sc-63178. Sep 58, 16p. 4 refs. M. L. rept. no. 546.
Order from LC mi$2.40, ph$3.30 PB 144 314

The first project involved development work on vacuum windows for high-power microwave tubes. This is a significant aspect of the development of long-life, sealed-off tubes, and of the development of higher power broadband tubes. At the close of this contract a test facility for high-power windows had been constructed and was in operation. This instrument is called a "Circulator," and is being used for the testing of a number of types of high-power windows. The circulator, after some revision, has proved to be a very satisfactory device. Power gains on the order of 20 may readily be obtained, and it is possible to subject the windows under test to peak powers of 20 megawatts or higher. A number of tests have already been made, using both actual operating windows and also slabs of various experimental materials. These are reported here, and a description of the circulator and its operation is given. Use of this device will undoubtedly contribute significantly to the understanding of the mechanisms of failure in high-power windows.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
MODAL ANALYSIS AND SYNTHESIS OF ELECTROMAGNETIC FIELDS, by L. B. Felsen and N. Marcuvitz. Rept. on Contract AF 19(604)2031. 19 June 59, 85p. 6 refs. Research rept. R-726-59; PIB-654; AFCRC-TN-59-583.
Order from LC mi$4.80, ph$13.80 PB 144 341

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
ON THE IDENTIFICATION AND COMMAND PROBLEMS IN COMPUTER-CONTROLLED ADAPTIVE SYSTEMS, by E. Mishkin and R. A. Haddad. Rept. on Contract DA 30-069-ORD-2646. 3 Sep 59, 36p. 6 refs. Research rept. R-767-59; PIB-695; OOR rept. 2268-1-E.
Order from LC mi$3.00, ph$6.30 PB 144 213

In order to satisfy stringent performance requirements in a dynamic process, a computer is incorporated as a central element in the feedback loop. The computer performs the dual task of identifying or measuring the process' dynamics, and thence generating an appropriate command or actuating signal so as to satisfy the overall specifications. The family

of singularity functions (steps, ramps, confluent parabolas) is used as the command signal. The process' dynamics is monitored and identified by the computer without recourse to interrupting test signals such as periodic impulses or white noise. The stored energy term inherent in many measurement problems in continuous processes is accounted for in a novel manner.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y
THEORY OF THIN DIELECTRIC COVER ON SLITTED RECTANGULAR WAVEGUIDE ANTENNA, by S. Nishida. Rept. on Contract AF 19(604)2031. 13 July 59, 25p. 3 refs. Research rept. R-754-59; PIB-682; AFCRC-TN-59-593.
Order from LC mi$2.70, ph$4.80 PB 143 989

A thin dielectric sheet or slab which covers the radiating surface of a slitted rectangular waveguide can serve as a radome for this type of leaky wave antenna. Theoretical expressions are derived for the propagation constants of a leaky wave on a slitted rectangular waveguide which is covered by such a dielectric slab. Numerical results are presented in graphical form and show that only the attenuation constant of the leaky wave is significantly affected by the presence of the dielectric slab when its thickness is comparable to or greater than the width of the narrow slit.

Minneapolis-Honeywell Regulator Co., Minn.
INDUSTRIAL PREPAREDNESS STUDY ON GERMANIUM POWER TRANSISTORS, by V. K. Erickson, D. J. Noggle and others. Final rept. for 31 Mar 55-30 Sep 57 on Contract DA 36-039-sc-66044. [1957] 411p. 6 refs.
Order from LC mi$11.10, ph$63.60 PB 138 086

Industrial preparedness studies were undertaken to develop a Ge power transistor, and to develop facilities and equipment to mass reproduce this transistor. Extreme precautions must be observed to avoid contamination of the transistor during fabrication and assembly. Experimentation established that a solid encapsulating fill is detrimental to the electrical characteristics of the transistor. A solder seal was also unsatisfactory in that the solder flux introduces contamination. Some type of mechanical seal, such as welding, must be used. Extremely close control must be maintained over the alloying of the emitter, collector, and base ring to the Ge die during the time-temperature cycle. High temperature conditioning (48 hr at 100°C) tends to stabilize the electrical characteristic of the transistor. To obtain the most efficient dissipation of heat from the transistor junction, the thermal resistance of the conduction path from the collector to the external heat sink must be as low as possible. A good heat flow path from the transistor to the mounting surface is obtained by machining an angle of 0°15' on the bottom surface of the base block assembly. A 64 μ in. maximum surface roughness on this surface also insures a low thermal interface resistance. The effect of emitter geometry on the current carrying capacity of the transistor is discussed.

Missouri U., Columbia.
ELECTROCHEMICAL SYSTEMS FOR USE IN LOW TEMPERATURE BATTERIES, by G. V. Lago, J. P. Karnes and others. Final rept. for 17 Dec 58-15 Mar 59 on Contract DA 36-039-sc-74994. [1959] 55p. 2 refs.
Order from LC mi$3.60, ph$9.30 PB 143 899

The conductivities of KSCN-CH_3CN, KSCN-C_2H_5CN and $NaClO_4$-C_2H_5CN systems with and without H_2O have been investigated for both dilute and concentrated solutions. Freezing point measurements for the more concentrated electrolyte solutions were made. In addition the viscosities, dielectric constants, and densities of the solvents have been determined. Load tests have been made on a number of experimental cells employing KSCN-H_2O-CH_3CN electrolyte, MnO_2 Shawinigan Black cathodes and either Mg or Zn anodes. Initial and final "no load" voltages have been measured as well as the anodic voltages. Preliminary tests on cells employing $NaClO_4$-H_2O-C_2H_5CN as electrolyte have been made. The load tests were made at room temperature, -45, -50, and -54°C. The causes and effects of polarization and internal resistance were also studied. (See also PB 142 864)

Naval Avionics Facility, Indianapolis, Ind.
THE NOPI-WURF SUB-AUDIO FREQUENCY NOISE GENERATOR, by Robert E. Harrison. Jan 58, 30p. 3 refs. NAFI-TP-39.
Order from LC mi$2.70, ph$4.80 PB 144 185

This report describes a noise generator particularly suited for use in the simulation and study of noise problems in fire control computers and other types of electromechanical systems operating in the frequency range from zero to thirty cycles per second. This equipment was developed by the Washington University Research Foundation, St. Louis, Missouri, under contracts 163s-577 and 163s-1039 in conjunction with a radar noise study program. This report was written in October 1953, but was not prepared for publication due to termination of the author at that time. It is being published now because the noise generator described is currently in use, and the material herein should prove useful.

Naval Ordnance Test Station, China Lake, Calif.
A REVIEW OF MASER AMPLIFIERS, by Albert J. Jaske. 17 July 58, 21p. 15 refs. NOTS-2031; NAVORD rept. 5889.
Order from LC mi$2.70, ph$4.80 PB 144 077

The theory of operation of both the gas and solid-state maser is presented, and aspects of its use as a microwave amplifier, such as band width and noise, are discussed.

Naval Research Lab., Washington, D. C.
AN INVESTIGATION OF IMPULSE-VOLTAGE BREAKDOWN IN POLYETHYLENE, by C. R. Vail. Final rept. 9 Dec 59, 58p. 17 refs. NRL rept. 5374.
Order from OTS $1.50 PB 151 955

The study of the characteristics of dielectric break-

down in commercial polyethylene, under applied high-voltage impulses, divides naturally into two parts: one concerned with single-impulse breakdown during the period of rise of overvoltage impulses and the other concerned with multiple-impulse breakdown at gradients below the threshold level for single-impulse breakdown. Single-impulse breakdown is shown to be a function of rise rate, and to be characterized by breakdown gradients that exceed the dc breakdown level for very high rise rates but that may fall well below the dc level for lesser rise rates. It appears to be independent of thickness in the range from 1.5 to 26.5 mils. The fact that single-impulse breakdown data fit an extremal distribution suggests the applicability of the weakest-link theory. Although multiple-impulse breakdown data are too few for drawing statistically significant conclusions, there is some evidence that there is an inverse relation between breakdown gradient and number of impulses to breakdown. It is concluded that the process of impulse breakdown in commercial polyethylene involves a mechanism of electron avalanching that is influenced, for the lower rise rates, by partial breakdown associated with foreign matter, imperfections, and voids, while for higher rise rates, it is strongly influenced by "electrode conditioning" due to emission from the cathode. Prestressing is thought to increase the breakdown voltage through the electrode conditioning process and through a process of repairing defects in the material.

New York U. Coll. of Engineering, N. Y.
OPTIMIZATION OF THE ADAPTIVE FUNCTION BY Z-TRANSFORM METHOD, by S. S. L. Chang. Rept. on Contract AF 49(638)586. June 59, 39p. 15 refs. Technical rept. 400-6; AFOSR-TN-59-585; AD-217 032.
Order from LC mi$3.00, ph$6.30 PB 144 276

A study is made on the optimization of the adjustment process in a self-optimizing system under rather general assumptions. The system is designed to keep a performance parameter m either at a prescribed value or at an unknown extremal value. A direct measurement on m is made, and the adjustment is based on measured m only. Factors considered are (1) the finite measuring interval, (2) the necessity of looking ahead one interval, (3) the probable error in measurement, and (4) the changing situation. A set of weighting factors on present and past data, and the proper value of test bias for extremal seeking systems, are determined by a least square optimization process. The criterion of optimization is least reduction in m for peak seeking systems and least square error in m for systems with prescribed value of m. Two types of extremal seeking systems are studied. The alternate biasing systems are found to be superior in performance compared to the derivative sensing systems.

[Oxford U. (Gt. Brit.)]
AN S-BAND FERRITE ISOLATOR FOR USE WITH A LINEAR ACCELERATOR. Technical note no. 1 on Contract AF 61(514)1183. [1958] 5p. 4 refs. AFOSR-TN-58-654; AD-162 185.
Order from LC mi$1.80, ph$1.80 PB 138 108

A ferrite isolator that handles 1 megawatt of S-band is described. Results that show the great advantage of using an isolator when operating a magnetron with a narrow bandwidth load are given. It is pointed out that the use of isolators gives designers of electron accelerators freedom to use very high Q or variable impedance devices.

Pacific Semiconductors, Inc., Culver City, Calif.
TRANSISTOR, JUNCTION, DIFFUSED BASE, R. F. POWER OSCILLATOR, by S. H. Barnes, P. H. Dirnbach and others. Quarterly progress rept. no. 1, 27 June-30 Sep 58, on Contract DA 36-039-sc-78033. 68p. 4 refs.
Order from LC mi$3.90, ph$10.80 PB 144 153

Preliminary processes for the fabrication of a 1 w, 70 mc transistor are described. The transistor structure is discussed and a brief summary of the design equations given. Mechanical environmental tests which have been performed to date are discussed. The electrical characteristics of 100 state of the art samples delivered at the end of this period are tabulated and distributions of the important parameters are plotted and discussed.

Pacific Semiconductors, Inc., Culver City, Calif.
TRANSISTOR, JUNCTION, DIFFUSED BASE, R. F. POWER OSCILLATOR, by S. H. Barnes, L. Brown and others. Quarterly progress rept. no. 2, 30 Sep-30 Dec 58, on Contract DA 36-039-sc-78033. [1959] 43p. 4 refs.
Order from LC mi$3.30, ph$7.80 PB 144 156

The processes for the fabrication of the 1 watt, 70 mc power oscillator transistors have remained basically the same as in the previous report, but improvements in process control and reliability have been stressed. Process control effort has been particularly heavy in the diffusion processes. Environmental tests have been initiated and are providing valuable feed-back information. Progress in the design and development of a new environmentally-secure package capable of handling the required power dissipation and still adhering to the TO-9 dimensions is described. Characterization of the contract transistors is continuing. Oscillator and amplifier circuitry and measurements are discussed. (See also PB 144 153)

Philco Corp., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON SILICON MICROWAVE DIODES, by W. H. Forster. Quarterly rept. no. 1, 1 July-30 Sep 57, on Contract DA 36-039-sc-75943. [1957] 43p. 1 ref.
Order from LC mi$3.30, ph$7.80 PB 138 098

Tools to fabricate 1N26 and 1N78 silicon microwave diodes have been designed and built during this period. Diodes have been assembled in order to check these tools and to develop fabrication techniques. No attempt has been made, as yet, to obtain an hermetic seal in these diodes. Various bead materials have been tried in order to determine the optimum material with respect to electrical requirements and hermetic sealing.

Philco Corp., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON SILICON MICROWAVE DIODES, by W. H. Forster. Quarterly rept. no. 2, 1 Oct-31 Dec 57, on Contract DA 36-039-sc-75943. [1958] 33p. 1 ref.
Order from LC mi$3.00, ph$6.30 PB 138 102

Silicon microwave diodes types 1N26 and 1N78 produced on a pilot production line.

Philco Corp., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON SILICON MICROWAVE DIODES, by W. H. Forster. Quarterly rept. no. 3, 1 Jan-31 Mar 58, on Contract DA 36-039-sc-75943. [1958] 34p. 3 refs. AD-206 159.
Order from LC mi$3.00, ph$6.30 PB 138 103

Types 1N26 and 1N78 silicon microwave diodes were prepared. (See also PB 138 102)

RCA Service Co., Camden, N. J.
ELECTRONIC DESIGNER'S SHOCK AND VIBRATION GUIDE FOR AIRBORNE APPLICATIONS, by Robert E. Barbiere and Wayne Hall. Rept. on Contract AF AF 33(616)3257. Dec 58, 260p. 126 refs. WADC Technical rept. 58-363; AD-204 095.
Order from OTS $4.00 PB 161 299

Improvements in the mechanical design of airborne electronic equipment have not kept pace with advances in electrical design. The resulting major inadequacy has been the inability of some equipments to resist a shock and vibration environment. This book is a guide for the designer of airborne electronic equipment to aid him in designing resistance to shock and vibration into equipments. Both the theoretical and practical aspects of shock and vibration are covered. The discussion of shock and vibration concepts and the philosophical approaches to shock and vibration problems serve as a foundation for understanding the complete publication. This makes it unnecessary for the electronics designer to have prior shock and vibration knowledge. Environmental data reveal to the designer the levels of shock and vibration excitation to which electronic equipments are subjected. The practical applications of shock and vibration design practices are emphasized. The relative susceptibilities of component parts and the effects of the mounting orientation of component parts in the equipment are presented. Also covered are the design of racks and chassis for best resistance to shock and vibration and the use of auxiliary means, such as damping or isolation, for either resisting or changing the environment. The balance of the design guide considers the test methods and facilities that can give reasonable assurance that the equipment will eventually be able to withstand its operational environment. A thorough discussion is given of shock and vibration simulators and instrumentation as well as the philosophy of performing laboratory tests.

Rome Air Development Center, Griffiss AFB, N. Y.
AUTOMATIC GROUND CONTROL APPROACH SYSTEM AN/MSN-3, by Rainey M. Brooks and William F. Hoy. June 59, 69p. RADC-TR-59-32; AD-228 502, superseded, AD-211 936.
Order from LC mi$3.90, ph$10.80 PB 144 219

This report presents a general description of the AGCA System and the results of evaluation tests on the system. The tests proved that the AGCA System, utilizing the AN/MSN-3 and the AN/ARR-43, will provide USAF with an approach capability it does not now operationally possess. The report also includes the final tests on the modified Serial #2 AGCA System, as accepted by RADC prior to E & ST by Air Proving Ground Center.

Rome Air Development Center, Griffiss AFB, N. Y.
THE EFFECTS OF WIDE-BAND SIGNALS ON RADAR ANTENNA DESIGN, by Lawrence R. Dausin, Kenneth E. Niebuhr, and Nils J. Nilsson. July 59, 20p. 6 refs. RADC-TN-59-178; AD-216 023.
Order from LC mi$2.40, ph$3.30 PB 144 080

The angle of arrival of a plane wave incident on a line aperture depends on the bandwidth of the incident signal as well as on the extent of the aperture. Conventional antenna theory assumes the angular resolution of an antenna depends only on the aperture extent and illumination function. However, by auto-correlation techniques further angular resolution can be obtained. This additional directivity depends on the extent of the signal bandwidth. The obtainable directivity information for line arrays depends on the aperture illumination function and the auto-correlation function of the incident signal. In view of the vast amount of available information concerning conventional antennas, the results of this report have been related to conventional antenna theory. The antenna designer can specify the desired directivity pattern in terms of a conventional single-frequency aperture illumination function. The effects of this single frequency illumination function can then be achieved for wideband signals by a simpler illumination function. Some examples of the theory are given.

Rome Air Development Center, Griffiss AFB, N. Y.
IMPROVED MILITARY BEACON SYSTEM, by Olindo A. Tagliaferri. Sep 59, 31p. RADC-TN-59-235; AD-226 863.
Order from LC mi$3.00, ph$6.30 PB 144 298

The continued development and use of the Mark X SIF Beacon System has generated many problems especially in reference to high density employment areas. The ability of the system to operate in a particular congested area is part of an overall test program conducted in the New York City area. New techniques to suppress side lobe interference and fruit are described. Test results are given and it is concluded that receiver subtraction shows promise of significantly reducing ring around and eliminating fruit on the display.

Rome Air Development Center, Griffiss AFB, N. Y.
SOLID STATE REAL TIME FAULT ALARM FOR TELETYPE EQUIPMENT, by Murray Kesselman. Sep 59, 17p. RADC-TR-59-70.
Order from LC mi$2.40, ph$3.30 PB 144 484

A solid-state real-time fault alarm was developed to alert Communications Center operators to malfunctions in automatic operation of cryptographic equipment. A detailed technical discussion of the equipment is given.

Rome Air Development Center, Griffiss AFB, N. Y.
TRANSISTORIZED, FOUR-CHANNEL RADIO REMOTE CONTROL UNIT (CONTROL, RADIO SET C-2767/MR) by John J. Guba and William E. Wilbur. Aug 59, 29p. RADC-TR-59-108; AD-225 510.
Order from LC mi$2.70, ph$4.80 PB 144 070

This report describes a radio remote control unit (Control, Radio Sec C-2767/MR) developed by the Rome Air Development Center and fabricated by Allen B. DuMont Laboratories, Inc. The unit provides two-wire operational control of from one to four continuous-wave or voice-modulated transmitters and/or receivers (channels) from a central location (up to three miles from the radio equipments). All operating controls for radio equipments are grouped by channel on the front panel of the unit. Three radio remote control units may be interconnected to provide a maximum of 12 channels at one location. Channels may be shared by paralleling up to eight radio remote control units situated at widely separated locations. Lockout circuitry incorporated in the units prevents the use of a shared channel at more than one location at a time, thereby eliminating any interference or confusion. The unit is of compact design, is transistorized, and features plug-in modular construction. Side-tone oscillators enable monitoring of c-w transmissions, and squelch circuits eliminate output noise when receivers are not in use.

Servo Corp. of America, New Hyde Park, N. Y.
DEVELOPMENT OF A DIRECT-READING FREQUENCY METER. Final progress rept. for 1 Nov 53-31 Dec 54 on Contract DA 36-039-sc-15416. 5 Apr 55, 186p. 23 refs. SCA-3700-RQ5.
Order from LC mi$8.40, ph$28.80 PB 144 021

The format of the present report is arranged so that a reader familiar with the preceding quarterly reports can turn directly to Section 2 which describes the work performed in the interval from 18 November 1953 to 31 December 1954. In Section 2 it is shown that a frequency meter based on the simplified instrumentation has been developed as far as the available wide-range tuning-element art permits. An experimental model of limited performance has been constructed. It is concluded that this basic method of frequency measurement is sound and worthy of further development particularly for higher frequency use. Component development is essential in regard to the wide-range tuning element and is desirable in regard to the counter or register element. A reader not familiar with the preceding reports should direct his attention first to Appendix B, which summarizes the total work performed from the initiation of the project in September 1951 to November 1953. Appendix B describes the originally-proposed instrumentation of the basic method of frequency measurement and the greatly simplified instrumentation which was later adopted for development. Operating sequences and the development of the functional elements are also treated in Appendix B.

Stanford Electronics Labs., Stanford U., Calif.
EXPERIMENTS ON A HIGH-PERFORMANCE CAVITY MASER USING RUBY AS S-BAND, by W. S. C. Chang, J. Cromack and A. E. Siegman. Rept. on Contract AF 33(600)27784. 21 July 59, 27p. 4 refs. Technical rept. no. 156-4; AD-226 295.
Order from LC mi$2.70, ph$4.80 PB 144 061

A 3-level solid-state maser using ruby was operated at frequencies near 3000 mc, using a high-efficiency cavity having TEM modes in a rectangular geometry. Two different operating points in the $\theta = 10^{o}$ to $\theta = 30^{o}$ region of the ruby spectrum gave maser operation with a pump frequency near 10,500 mc, although the inversion obtained was a sensitive function of the exact operating point. An operating point at $\theta = 90^{o}$, requiring pumping at 13,500 mc, gave a gain-bandwidth product of better than 50 mc. It was found possible to pump the 1-4 or $\Delta M = 3$ transition at this same operating point, obtaining 3000 mc amplification with a 23,700 mc pump frequency. Although this mode of operation was not fully explored, it is potentially capable of increasing the gain-bandwidth product by a substantial amount.

Stanford Electronics Labs., Stanford U., Calif.
FERRITE ATTENUATORS FOR TRAVELING-WAVE TUBES, by L. C. Bacon. Technical rept. no. 26 on Contract Nonr-225(24). 11 Feb 58, 181p. 26 refs. AD-153 715.
Order from LC mi$8.40, ph$28.80 PB 138 346

Several ways of employing ferrites in traveling-wave-amplifier attenuator systems are evaluated. The properties of conventional attenuators are reviewed with special attention given to the interrupted-circuited type. The phenomena of nonreciprocal absorption in the region of resonance for a gyromagnetic material is considered. In a discussion of the experiments with the use of ferrites in conjunction with TWT's several difficulties are pointed out, including dielectric loading, beam defocusing, and alteration of circuit phase velocity. Suggestions for ameliorating the conditions are given. A modified version of S. E. Miller's coupled-mode theory is employed to study 2 methods of utilizing nonreciprocal coupled helices with ferrites based above resonance. A description is given of the design and operation of a high power circuit for a travelling-wave amplifier circuit that uses a ferrite attenuator. Comparison is made with the performance of a severed circuit attenuator. The general characteristics of the ferrite attenuators are briefly discussed.

Stanford Electronics Labs., Stanford U., Calif.
GAIN, BANDWIDTH AND NOISE CHARACTERISTICS OF THE VARIABLE-PARAMETER AMPLIFIER, by H. Heffner and G. Wade. Technical rept. no. 28 on Contract Nonr-225(24). 26 Feb 58, 35p. 8 refs. AD-153 170.
Order from LC mi$3.00, ph$6.30 PB 138 141

The variable parameter (or parametric) principle of amplification is characterized by a typical arrangement in which a variable energy-storage element, such as an inductor or a capacitor, is suitably coupled to two resonant circuits. If the value of the energy-storage element is made to vary in the proper way, energy is fed from the source which drives the element (that is, the pump) to the fields of both the resonant circuits. This paper describes the behavior relative to gain, bandwidth and noise of this type of amplifier.

Stanford Electronics Labs., Stanford U., Calif.
A SEMICONDUCTOR-DIODE PARAMETRIC AMPLIFIER AT MICROWAVE FREQUENCIES, by K. L. Kotzebue. Technical rept. no. 49 on Contract Nonr-225(24). 4 Nov 58, 78p. 34 refs.
Order from LC mi$4.50, ph$12.30 PB 143 735

Extensive measurements were made of the microwave characteristics of the type of diode used in the experimental parametric amplifier, with emphasis on the measurement of series resistance. For this diode, a welded-contact germanium diode, the series resistance was a function of frequency, decreasing at a rate of nearly 3 db per octave over the frequency range of 500 Mc to 3,500 Mc. These measurements indicate that the germanium diode may be useful in parametric amplifiers at frequencies much higher than those predicted on the basis of low-frequency measurements.

Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF METHODS OF SCANNING THE BEAM OF LARGE ANTENNAS, by J. S. Honda and E. D. Sharp. Scientific rept. 8, 1 Mar-31 May 59, on Contract AF 19(604)2240. June 59, 43p. 5 refs. AFCRC-TN-59-590; AD-226 524.
Order from LC mi$3.30, ph$7.80 PB 144 310

Research continued on the investigation of both mechanical and electrical methods of scanning the beam of large ground-based antennas. The measured performance of an experimental, low-noise up-converter, variable-reactance amplifier, suitable for use with an electronic-scanning receiving array, is presented. The amplifier utilized a back-biased diffused junction diode as the variable-reactance element and was operated both as a two-frequency and as a three-frequency up-converter. An analysis is presented of an array with its antenna elements arranged in a triangular pattern. The reduction in number of antenna elements obtained by arranging them in a triangular pattern over that obtained when they are arranged in the usual rectangular pattern is presentec for several ranges of main beam scan angle. It is found that if the main beam is positioned within a constant angle about the normal to the array, the number of antenna elements can always be reduced 13.4 percent by arranging the elements in a pattern of equilateral triangles rather than in the usual square pattern.

Stavid Engineering, Inc., Plainfield, N. J.
INVESTIGATION OF TECHNIQUES FOR DISPLAYING INFORMATION IN AN AIR TRAFFIC CONTROL CENTER, by Richard A. Barker and Robert G. Hertz. Rept. on Contract AF 19(604)1508. May 57, 43p. 9 refs. AFCRC-TR-57-160; AD-117 013.
Order from LC mi$3.30, ph$7.80 PB 138 072

Several types of display were investigated to determine their suitability for use in an enroute ATC center. These devices fall into the categories of (1) large screen projection displays, both photographic and optical-electronic; (2) character writing techniques; (3) third-dimensional presentation; and (4) special (miscellaneous) displays. The problem of displaying radar information on a bright, large-screen display with high accuracy and fine resolution can be solved with the use of a film processor. This entails a major disadvantage: a time lag because of photographic processing time is introduced between the collection of signals by the radar and the presentation of the same information to the controller. The optimum antenna azimuth scan rate of a radar employing photographic projection in its display should be equal to (or less than but never greater than) the film cycling rate.

Sylvania Electric Products, Inc., Mountain View, Calif.
DEVELOPMENT OF LOW-NOISE BACKWARD-WAVE AMPLIFIER TUBE, by Robert E. Vehn. Final rept. on Contract DA 36-039-sc-73181. Apr 59, 138p. 39 refs.
Order from LC mi$6.90, ph$21.30 PB 144 302

The design, construction, and performance of experimental low-noise backward-wave amplifiers electronically tunable over the 12- to 18-kmc frequency range are reported. The design objectives were 50 mc constant bandwidth over the tuning range, and 20 db gain. Both two- and three-helix cascade designs were investigated. The development of the hollow-beam electron gun is described. The performance of the experimental tubes is summarized, and recommendations for further activity are made.

Technical Research Group [Syosset, N. Y.]
TECHNICAL GAIN, by A. F. Kay. Rept. on Contract AF 19(604)5532. Aug 59, 42p. 17 refs. Scientific rept. no. 131-1.
Order from LC mi$3.30, ph$7.80 PB 144 248

Formulas for the ratio η of received to transmitted power are derived and examined for aperture antennas at any range (a) including supergain and (b) excluding supergain. Only case (b) is considered thereafter. In the far field this formula reduced to the "range equation," which is basic in communications systems design. Some simple illuminations which can be realized practically by defocussed dishes are shown to be sufficiently close to the optimum cases for most practical purposes. A formula for the power density in the near field of a transmitting aperture is also derived and it is shown how to maximize the power flow through any given area of space by design of the transmitting aperture illumination.

Technische Hochschule, Munich (Germany).
INVESTIGATION OF ATMOSPHERICS IN THE FREQUENCY RANGE OF 0-100 CYCLES PER SECOND BY MEANS OF MEASUREMENTS WITH NARROW BAND AMPLIFIERS, by Hans Gunther Jungmeister. Final technical rept. for 1 Oct 58-30 Sep 59 on Contract DA 91-591-EUC-956. [1959] 30p.
Order from LC Mi$2.70, ph$4.80 PB 144 251

A survey is given on the possibilities for realizing narrow band amplifiers for extremely low frequencies. It was found that feed back amplifiers with twin-T RC networks in the feed-back loop are most suitable for lowest frequencies. Such a feedback amplifier filter is theoretically analyzed as to whether it can be used as frequency analyzer. Special methods for measur-

ing and calibrating the Q and the spectral amplitudes are shown. These methods are based on the application of the frequency spectrum of short square pulses.

Transistor Applications, Inc., Boston, Mass.
INVESTIGATION OF THE APPLICATIONS OF NEGATIVE RESISTANCE DIODES FOR SWITCHING CIRCUITS, by A. W. Carlson. Scientific rept. no. 4, 16 Mar-17 June 59, on Contract AF 19(604)3066. [1959] 57p. AFCRC-TN-59-769.
Order from LC mi$3.60, ph$9.30 PB 143 978

This report is concerned with the study and investigation of pulse circuit applications of three-terminal negative resistance devices. The RCA 1832 Thyristor is used as a representative type in the study of the following applications: (1) Capacitive type multivibrators using emitter and collector negative-resistance characteristics. (2) Inductive multivibrator using the base input negative resistance characteristic. (3) Blocking oscillator using transformer feedback. (4) Ring counter. (See also PB 142 804)

Ordnance, Missiles, and Satellite Vehicles

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
THE HEAT PROTECTION POTENTIAL OF SEVERAL ABLATION MATERIALS FOR SATELLITE AND BALLISTIC RE-ENTRY INTO THE EARTH'S ATMOSPHERE, by N. S. Diaconis, J. B. Fanucci, and G. W. Sutton. Rept. on Contract 04(647)269. 11 Sep 59, 65p. 18 refs. Technical information series R59SD423.
Order from LC mi$3.90, ph$10.80 PB 143 901

An evaluation of the relative performance advantage of various ablation materials for the heat protection to a non-lifting vehicle during hypersonic re-entry into the earth's atmosphere has been made based on theoretical ablation models substantiated by experiment. Calculations have also been made of the heat penetration within the material. Typical ablation materials from three categories have been investigated, both theoretically and experimentally in air arc facilities at a hypersonic stagnation point. Stagnation point ablation data for an attractive material in each category was obtained for various local heating rates, stagnation pressures and stagnation enthalpies. Effective heats of ablation have been determined experimentally and compared with the theoretical calculations.

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
A STUDY OF HYPERSONIC ABLATION, by Sinclaire M. Scala. Rept. on Contract AF 04(647)269. 30 Sep 59, 64p. 45 refs. Technical Information Series R59SD438.
Order from LC mi$3.90, ph$10.80 PB 143 879

The aerothermochemical response of four broad classes of materials to the severe heating encountered during the hypersonic re-entry of space vehicles is determined theoretically. These materials include quartz-like refractories, graphite, thermosetting plastics and thermoplastics. A unified treatment of the ablation of different classes of materials has been developed. The effective heat of ablation of each material depends critically on the enthalpy level of the flight environment, and increases with increasing flight speed. The effect of an increase in stagnation pressure is to promote a decrease in the effective heat of ablation. The specific area of greatest uncertainty is in the kinetics of condensed phase heterogeneous reactions.

Air Force Missile Development Center, Holloman AFB, N. Mex.
ON SATELLITE ORBITS. IV. SOME NEW METHODS OF SATELLITE ORBIT CALCULATIONS AND STABILITY PROBLEMS, by Herbert Knothe. Sep. 59, 24p. 2 refs. AFMDC-TR-59-37.
Order from LC mi$2.70, ph$4.80 PB 143 992

In Chapter I the equations of motion for a satellite in a rotationally symmetric gravity field are reduced to a system of two ordinary first order differential equations for p and 1/r as functions of the angular polar distance θ by first introducing the arc length s of the spherical image of the orbit on the unit sphere as independent parameter. In Chapter II a system of three ordinary first order differential equations for p, ξ, ϕ_o as functions of ϕ (ϕ defined by $\cos\theta = \sin i \sin\phi$, ϕ_o corresponds to the apogee) is derived. A rapidly convergent process of iteration for solving these equations is explained and explicit examples are given. In Chapter III a differential geometrical approach is applied which leads to simple formulae for the calculation of the regression. A vector integral equation is derived for the deviation of the satellite from the plane of the initial osculating ellipse. (See also PB 142 376)

Air Force Missile Development Center, Holloman AFB, N. Mex.
SOME GENERAL CONSIDERATIONS OF THE PROBLEM OF DETERMINING THE ORIENTATION OF A STABILIZED PLATFORM IN MOVING ROCKET SLED, by H. Palmer Hotz. Nov 59, 11p. 1 ref. AFMDC-TN-59-30.
Order from LC mi$2.40, ph$3.30 PB 143 993

The problem is to locate accurately, and with respect to the ground, a stabilized platform inside a rocket sled while it is traveling down the track. Of various methods, only optical methods appear to be practical for making these measurements. Two general classes of optical methods could be used: optical levers, and measurements of the plane of polarization. The optical lever method is shown to be impossible unless the deflection caused by the shock wave is known. The polarization method can probably be made to work on the track.

Air Force Missile Test Center, Patrick AFB, Fla.
POWER SERIES SOLUTION OF ROCKET EQUATIONS OF MOTION, by Robert C. Meacham. Rept. on Missile Test Project, Contract AF 08(606)1156. 18 Sep 59, 109p. 8 refs. RCA Data Processing

Technical rept. no. 45; AFMTC-TR-59-18.
Order from LC mi$5.70, ph$16.80 PB 143 990

The equations of motion of a powered rocket subject to aerodynamic and gravitational forces are nonlinear and consequently solutions are difficult to obtain analytically. Numerical solutions are commonplace, however, due to the arithmetic capabilities of high speed digital computers. For general study an analytical solution in terms of physical parameters is usually preferable to particular solutions in the form of numerical tables. In this paper analytical solutions under various conditions will be approximated in the form of truncated Taylor's Series expansions. The position coordinates of the rocket are presented as polynomial functions of time, after the series are truncated

Allied Research Associates, Inc., Boston, Mass.
LAUNCHING OF AIRBORNE MISSILES UNDERWATER. PART II. RESPONSE OF A SLENDER MISSILE TO SEA AND SWELL, by Theodore R. Goodman and Eugene L. Krasnoff. Rept. on Contract Nonr-2343(00). 31 Dec 58, 26p. 4 refs. Document no. ARA-528.
Order from LC mi$2.70, ph$4.80 PB 144 117

The technique of generalized harmonic analysis is employed to evaluate the trajectory responses of a hydrodynamically unstable slender missile moving vertically towards the free surface of a sea with waves. The free surface of the sea is represented by a Gaussian random function. The wave spectrum is composed of the sum of the spectrum of a stormy sea (waves generated by a local storm) and the spectrum of a swell (waves generated by a distant storm). The Neumann-Pierson spectrum is employed for the stormy sea and a line spectrum is assumed for the swell. The missile considered is a body of revolution without fins and its forward speed is taken as constant. General expressions for the mean squares and the correlation coefficients of the trajectory response components are presented in forms which are suitable for numerical evaluation. (See also PB 139 965)

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
AN EVALUATION OF MODE SELECTOR SWITCH ARRANGEMENTS, by Gurdon B. Wattles, Edward C. Weiss, and David E. Holzen. Aug 59, 20p. Technical memo. 10-59.
Order from LC mi$2.40, ph$3.30 PB 144 078

A study was initiated to determine the optimum switching arrangement in terms of operator performance for the selection of the track, acquisition and search modes for a proposed AA weapon system. Five switching arrangements were evaluated and these constituted the independent variable conditions. The dependent variables were: (1) Errors of omission; (2) Errors of commission; (3) Breakdown rate; and (4) Subjective statements of preference. One hundred subjects from the Ordnance School, Aberdeen Proving Ground, Maryland were examined in terms of their performance on the various switching arrangements using time as a stressor.

[Army Rocket and Guided Missile Agency] Redstone Arsenal, Ala.
GRAIN DESIGN HANDBOOK, by Baylen Kaskey. 8 June 56, 267p. Rept. no. 3Y12.
Order from LC mi$11.10, ph$41.10 PB 144 125

Parameters for five types of solid-propellant grain configurations have been worked out by digital computer and are presented here. A method of using these results to solve most types of grain design problems is given. The equations and approximations necessary in grain design are presented and explained in handbook fashion.

Army Signal Missile Support Agency, White Sands Missile Range, N. Mex.
AN/DRW-13 (XO-1) RECEIVER SPECTRUM UTILIZATION, by Merwin A. Olson and William E. Castilo. 9 Oct 59, 25p. AFC Rept. DC 9-10-59-RdeC.
Order from LC mi$2.70, ph$4.80 PB 144 280

Results are presented on a partial laboratory investigation of the interference characteristics (affecting spectrum utilization) on an AN/DRW-13 Drone Control Receiver. This information is necessary for frequency allocation purposes. This FM receiver operates in the frequency range from 406 to 549 MCS with signals having 300 KCS deviation. Selectivity, spurious emissions and responses, and interference characteristics were determined empirically. Selectivity was 359 KCS at the half power points. A clear channel width, involving two identical receivers, of 1600 KCS is recommended for J/S ratios of 20 db.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE RESPONSE OF TAPERED CANTILEVER BEAMS WITH A TERMINAL MASS WHEN A CONSTANT FORCE IS APPLIED INSTANTANEOUSLY AT THE MASS, by A. S. Elder. Apr 56, 54p. 24 refs. Rept. no. 979.
Order from LC mi$3.60, ph$9.30 PB 144 034

Interaction of a high-speed aircraft machine gun and the mounting structure may severely affect the functioning of both the gun and the mount. An adequate mount may be constructed by mounting the gun in the center of a uniform beam which is hinged or fixed at the ends. Considerations led to the design and construction of an elastic mount in which flat plates were tapered linearly so as to give cantilever beams of constant static bending strength.

California U., Los Angeles.
DIFFERENTIAL EXPRESSIONS FOR LOW-ECCENTRICITY GEOCENTRIC ORBITS, by Samuel Herrick, Louis G. Walters, C. Geoffrey Hilton. Astrodynamical rept. no. 2 on A Range Planning Study for Project Mercury, Contracts [NASA-204] and AF 49(638)498. 11 June 59, 31p. 3 refs. AFOSR-TN-59-768.
Order from LC mi$3.00, ph$6.30 PB 144 277

In the planning and evaluation of a tracking complex for space vehicles, two functions are served by differential expressions relating uncertainties, errors,

or corrections in selected orbital elements to corresponding uncertainties, errors, or corrections in the observed coordinates. These functions are: (1) The translation of orbit uncertainties into observed quantities, or vice versa, for an evaluation of ability to correct an orbit from given observations, or for an evaluation of the accuracy of an ephemeris based upon these observations. (2) The translation of residuals in observed coordinates into differential corrections to the orbital elements (or parameters). The analysis presented here is divided into two steps because of the need for data intermediate between the parameters and the ephemeris.

California U., Los Angeles.
EFFICIENT PRECISION ORBIT COMPUTATIONAL TECHNIQUES, by Robert M. L. Baker, Jr., George B. Westrom, and others. Rept. on Contracts AF 49(638)498 and DA 04-495-ORD-1389. 11 June 59, 77p. 22 refs. Astrodynamical rept. no. 3; AFOSR-TN-59-766.
Order from LC mi$4.50, ph$12.30 PB 144 014

A comparison is made of the methods of Cowell's, Encke's and the variation-of-parameters for the computation of high-precision orbits. Analysis of the integration of an analytical three-body trajectory and an analytical low-thrust spiral trajectory indicated the importance of decreasing the overall number of integration steps to avoid round-off errors. Comparative computations demonstrated that Encke's method is preferable in the ballistic lunar trajectory, variation-of-parameters in the low-thrust trajectory, and Cowell's method in the high-thrust trajectory. The overall computational efficiency of the Encke's and the variation-of-parameters method is also shown.

California U., Los Angeles.
PRECISION ORBITS AND OBSERVATION REDUCTION, by Samuel Herrick. Astrodynamical rept. no. 1 on Contracts AF 49(638)498, AF 33(616)6005, NOas-59-6110-C, DA 04-495-ORD-1389, and NASA-204. 11 June 59, 25p. AFOSR-TN-49-769.
Order from LC mi$2.70, ph$4.80 PB 144 278

The advantages and disadvantages, in the reduction of observations, of "fixes", triangulation, assumed motions or orbits, reduction to the center of the Earth, and reference systems are discussed in the light of astrodynamical experience and the requirements of different types of orbit and of errors of observation. The differential correction is defined and outlined. The "fix" and "complete observations" are discussed in relation to the determination of orbits and compared with the differential correction. The provinces of observer and orbit analyst are differentiated. The need for accurate observations and reductions is stressed.

Cryogenic Engineering Lab., National Bureau of Standards, Boulder, Colo.
CRYOGENIC MATERIALS DATA HANDBOOK: MASTER GRAPHS. Contract AF 04(647)59-3. 10 Dec 59, 36p.
Order from OTS $1.00 PB 161 093-2

See PB 161 093

Diamond Ordnance Fuze Labs., Washington, D. C.
CHEMICAL TRANSDUCERS (PROPOSED PROGRAM), by Raymond H. Comyn. 28 May 59, 12p. 9 refs. Technical rept. TR-727.
Order from LC mi$2.40, ph$3.30 PB 144 388

Chemical transducers are those which use chemical reactions in their input, intermediate, or output stages. This report reviews the basic problem of using chemical transducers as sensing devices for ordnance applications. The use of chemical reactions in transducers is discussed, and a summary is made of chemical reactions which are applicable to transducers. It is recommended that a search be made for literature on chemical transducers, and on chemical reactions which are thought to be suitable for future transducers.

General Electric Co. [Schenectady, N. Y.]
AEROELASTIC EFFECTS ON CENTER OF PRESSURE AND NORMAL FORCE COEFFICIENTS, by Helen C. Engvold and Otto Klima, Jr. 24 Nov 52, declassified. 3p. 1 ref. Hermes A-3A Aerodynamic Data Memo. 24G.
Order from LC mi$1.80, ph$1.80 PB 144 357

This memorandum does not affect the validity of previously distributed memos on center of pressure and normal force coefficients. It merely shows the forward movement in the center of pressure and the reduction in missile normal force, caused by deflection of the nose, afterbody, and fins under load. It is necessary to consider these aeroelastic effects in determining the static stability margin for the various trajectories.

General Electric Co. [Schenectady, N. Y.]
AEROELASTIC EFFECTS ON THE FIN NORMAL FORCE COEFFICIENTS, by Otto Klima, Jr. and Patricia E. Adams. 14 Jan 53, declassified. 2p. 2 refs. Hermes A-3A Aerodynamic Data Memo. 3E.
Order from LC mi$1.80, ph$1.80 PB 144 367

This memorandum does not affect the validity of Memo #3D. It merely shows the change in fin normal force coefficient per degree fin deflection as affected by the dynamic pressure. It should be used with Memo #24G to calculate trim conditions for the missile subjected to air loads.

General Electric Co. [Schenectady, N. Y.]
BASE DRAG COEFFICIENTS FROM FLIGHT TEST - ROUNDS 1 AND 3, by Harold L. Bloom and Constance Carhart. 17 Feb 54, declassified 28 May 58. 8p. Hermes A-3A Aerodynamic Data Memo. 7F.
Order from LC mi$1.80, ph$1.80 PB 144 364

This memorandum presents jet-on base drag coefficients derived from flight test measurements of base pressure on Rounds 1 and 3, which were fired on the same theoretical trajectory. Jet-off base pressures are not available for these rounds. No usable base pressure data were obtained from Round 2. The information contained herein is to be considered as a preliminary step toward revision of estimated A-3A

base drag coefficients. Such revision, however, of A-3A Aerodynamic Data Memorandum #7D should await the additional data from Rounds 4 through 7, which were fired on a different trajectory from Rounds 1 through 3.

[General Electric Co., Schenectady, N. Y.]
COMPLETE MISSILE CENTER OF PRESSURE AND NORMAL FORCE COEFFICIENT, by O. Klima, Jr. 9 Mar 53, declassified, 1p. Hermes A-3A Aerodynamic Data Memo. 24H.
Order from LC mi$1.80, ph$1.80 PB 144 356

Recent wind tunnel tests on the Hermes A-3A at M-4.06 and 4.50 indicate that the center of pressure in this Mach number range is slightly aft of predicted values. Since this information does not appreciably affect the performance of missiles through #8 a new aerodynamic memorandum will not be issued. Memorandum 24G can be considered final. The effect of pitch angle on stability in the yaw plane was also investigated and found to be negligible for the angle of attack range of missiles through #8. The results of these high Mach number tests are filed in DFB 53 AO 534 and the final results will be issued in a Jet Propulsion Laboratory report. The report is here quoted in its entirety.

[General Electric Co., Schenectady, N. Y.]
COMPLETE MISSILE DRAG COEFFICIENT, by O. Klima, Jr. 9 Mar 53, declassified. 2p. Hermes A-3A Aerodynamic Data Memo. 7E.
Order from LC mi$1.80, ph$1.80 PB 144 365

The drag value given in Aerodynamic Data Memo #7D should be used for performance estimates of Hermes A-3A missiles through #8. Additional drag data for this missile will become available this summer from NACA free flight shoots of a 1/5 scale missile. By comparing this NACA data with drag measurements from the full scale firings of the A-3A, it should be possible to better predict the drag of the full-scale Hermes A-3B. At the present time it does not appear necessary to issue a new A-3A drag memo after the NACA data is obtained. This report is here quoted in its entirety.

[General Electric Co., Schenectady, N. Y.]
COMPLETE MISSILE SUPERSONIC NORMAL FORCE COEFFICIENTS AND CENTER OF PRESSURE, by Robert B. Chamberlin and Helen C. Engvold. 11 Aug 52, declassified. 8p. 3 refs. Hermes A-3A Aerodynamic Data Memo. 24-E
Order from LC mi$1.80, ph$1.80 PB 144 359

This memorandum replaces the supersonic portion of A-3A Aerodynamic Data Memorandum #24-D. Additional supersonic wind-tunnel tests at the Langley Laboratory have made it possible to further refine the original estimates and show the effects of increasing angles of attack. The subsonic data as given in A-3A memorandum 24-C are still valid.

[General Electric Co., Schenectady, N. Y.]
DRAG COEFFICIENTS, by Robert B. Chamberlin and Margaret A. Lavelle. 12 Aug 52, declassified. 8p. 5 refs. A-3A Aerodynamics Data Memo. 7D.
Order from LC mi$1.80, ph$1.80 PB 144 366

This memorandum revises and supersedes A-3A Aero. Data Memo. #7B to account for new information from NACA Free-flight tests for Mach number .8 to 1.4 and later base-drag data.

General Electric Co. [Schenectady, N. Y.]
EFFECTS OF EMERGENCY CUT-OFF ANTENNA ON HERMES A-3A AERODYNAMIC CHARACTERISTICS, by John O. Powers and Patricia A. Gill. 23 Apr 53, 1p. Hermes A-3A Aerodynamic Data Memo. 47.
Order from LC mi$1.80, ph$1.80 PB 144 352

A study has been made to determine the effect of the nose-mounted external emergency cut-off antenna on the Hermes A-3A aerodynamic characteristics. It was considered that the most probable detrimental effect due to the antenna would result from an induced rolling moment.

General Electric Co. [Schenectady, N. Y.]
EFFECTS OF LARGE PITCH ANGLES ON STATIC STABILITY IN YAW FOR SMALL YAW ANGLES, by Helen C. Engvold and Otto Klima, Jr. 12 Nov 52, declassified. 7p. Hermes A-3A Aerodynamic Data Memo. 24-F.
Order from LC mi$1.80, ph$1.80 PB 144 358

Results of wind tunnel tests recently conducted at Aberdeen at M=3.80 and M=2.47 to determine the effect of large angles of attack (in pitch) on the center of pressure of the force vector in the yaw plane, for small side slip angles, are presented.

[General Electric Co., Schenectady, N. Y.]
RESULTS OF FORCE TESTS TO DETERMINE BEST POSITION OF JET VANE, by George E. Bowden. 13 Sep 52, declassified. 4p. Hermes A-3A Aerodynamic Data Memo. 16D.
Order from LC mi$1.80, ph$1.80 PB 144 361

This memorandum does not supersede Hermes A-3A Aero. Data Memo. #16C but gives additional information. Hermes A-3A Aero. Data Memo. #16C is still valid for finding the expected values of jet vane forces, while this memorandum shows the effect of jet vane position on these forces. A series of tests have been made at Malta Test Station to determine the loss in jet vane lift due to moving the vanes outward from their original position. Tests were made with jet vanes in their original position (Jet Vane base 1/8" outward from nozzle wall) at 10^{o} and 20^{o} deflection angle. The vane was then moved so that the base was 1/2" outward from nozzle wall and tests made at 10^{o} and 20^{o} deflection angle. The vane was moved as far back as the test rig allowed (Jet Vane base 13/16" outward from nozzle wall) and another set of tests made.

General Electric Co. [Schenectady, N. Y.]
RESULTS OF JET-VANE FORCE TESTS, by R. E. Geiger. 9 Apr 53, declassified. 5p. Hermes A-3A Aerodynamic Data Memo. 16F.
Order from LC mi$1.80, ph$1.80 PB 144 360

The jet-van characteristics presented herein are based on an analysis of the results of a recent experimental investigation conducted at the Malta Test Station. In addition to the A-3A production vane design, an experimental design (designated GEB-11), incorporating a 45° leading-edge sweep, was also tested. This design is of interest because tail-ring burning tests (without a deflector skirt at the nozzle exit) have demonstrated that in contrast to the production type vane, it does not cause burning of the missile tail ring. In order to obtain center of pressure data this recent series of force tests utilized a 5-component strain gage balance of a type used in Hermes wind-tunnel tests.

General Electric Co. [Schenectady, N. Y.]
REVISED ESTIMATION OF TRANSIENT SKIN TEMPERATURE (HA-3A) (NOSE SECTION - STATION 60) by W. D. Breingan and W. W. Fischer. 31 Oct 52, declassified 28 May 58. 2p. 1 ref. Hermes A-3A Aerodynamic Data Memo. 12C.
Order from LC mi$1.80, ph$1.80 PB 144 363

The object was to recalculate HA-3A skin temperature at station 60 using the W.S.P.G. 61 nautical mile trajectory. Other refinements, such as using the Van Driest correction, variable specific heats, and more recent pressure data are also included.

[General Electric Co., Schenectady, N. Y.]
STATIC STABILITY MARGIN FOR ROUNDS 5-8 (61 MILE TRAJECTORY) by Patricia E. Adams and Otto Klima, Jr. 27 Oct 52, declassified. 13 refs. Hermes A-3A Aerodynamic Data Memo. 14B.
Order from LC mi$1.80, ph$1.80 PB 144 351

This memorandum supplements Aerodynamic Data Memorandum #14A by giving the static stability margin versus time for rounds 5-8. The nominal margin is affected by Reynolds Number and aeroelastic effects. Variations from the nominal, caused by atmospheric conditions, missile tolerances, program tolerances and wind-tunnel measuring tolerances are also presented.

[General Electric Co., Schenectady, N. Y.]
STATIC STABILITY MARGIN FOR ROUNDS 5-8 (61 NAUTICAL MILE TRAJECTORY) by Patricia E. Adams and Otto Klima, Jr. 28 Jan 53, declassified. 1p. 2 refs. Hermes A-3A Aerodynamic Data Memo. 14C.
Order from LC mi$1.80, ph$1.80 PB 144 362

This memorandum supplements Aerodynamic Data Memorandum #14B. A revised nominal trajectory study has been run on the ENIAC to account for minor changes in jet vane drag and total missile drag, and the results have been compared with the original. There is no significant difference between the normal static stability margins based on the original and the revised trajectories. This report is here quoted in its entirety.

Instrumentation Lab., Mass. Inst. of Tech., Cambridge.
AN OPTICAL ANALOG-DIGITAL TRANSDUCER FOR USE IN SERVO SYSTEMS, by Philip Warren Cheney. Rept. on Contract AF 04(645)09. Sep 58, 70p. 9 refs. Rept. T-189; AD-203 947.
Order from LC mi$3.90, ph$10.80 PB 144 223

An analysis of the Optisyn, an analog-digital transducer, in several types of servo systems is presented with emphasis upon the digital control features. The Optisyn consists of two glass disks with photographic patterns of alternate transparent and opaque sectors and a light source. As one of the disks is rotated, the resulting modulated light intensity is sensed by phototransistors. By using two cascoded pairs of these phototransistors, two output waveforms 90 degrees out of phase, are generated. These outputs are interpreted to yield shaft rotation or to control other servomechanisms.

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
EFFECTS OF METALLURGICAL VARIABLES ON GUN STEEL QUALITY, by C. Wells, C. C. Busby and others. Final rept. on Contract NOrd-12672, 1 Aug 58, 69p. 31 refs; AD-201 794.
Order from LC mi$3.90, ph$10.80 PB 144 054

Correlations between transverse reduction of area and yield strength and between transverse impact and yield strength have been determined for a number of heat-treated, low-alloy, medium-carbon, steel forgings. Basic information pertaining to the average, variation, and degree of control with respect to yield strength, transverse reduction of area, and transverse impact in heat-treated wrought steel products was obtained and utilized in the specification of steel for gun tube forgings.

Naval Ordnance Test Station, China Lake, Calif.
DESTRUCTOR CHARGES EX 25 AND EX 26 AND INTERVAL TIMER EX 1 FOR THE SUBROC FLIGHT-INTERRUPTER SYSTEM, by J. H. Davidson. 14 Aug 59, 32p. NOTS TP-2312; NAVORD rept. 6584.
Order from LC mi$3.00, ph$6.30 PB 144 202

The design, development, and test of two destructor charges, plus an interval timer--components of the Command Flight-Interrupter System for the SUBROC missile--are reported.

Office of Ordnance Research, Durham, N. C.
TRANSACTIONS OF THE CONFERENCE OF ARSENAL MATHEMATICIANS [NO. 4] AT PICATINNY ARSENAL, DOVER, N. J., 5-6 JUNE 1958. Apr 59, 158p. 13 refs. Rept. no. 59-1.
Order from LC mi$7.50, ph$24.30 PB 144 052

Picatinny Arsenal, Dover, N. J.
EVALUATION OF BEKEN MIXER FOR PROPELLANT MANUFACTURE, by K. H. Russell. May 59, 65p. Technical rept. DB-TR: 7-59; AD-225 204.
Order from LC mi$3.90, ph$10.80 PB 144 076

Studies with a 15 gallon unit indicate a Beken mixer can be successfully substituted for a sigma blade mixer for the mixing and colloiding of solvent-mixed cannon propellants. The Beken blade design gives good blending of ingredients and provides more efficient mixing action than a sigma blade mixer with solvent-mixed cannon propellants. Single-base propellant dough from a Beken mixer can be directly extruded without need for maceration or screening operations, and at no sacrifice of propellant quality. Triple-base propellant compositions of good quality can be mixed in a Beken mixer in 1/3 or less the time required in a sigma blade mixer for the same compositions. A Beken mixer is safe for use in the above applications. Use of 150-gallon Beken mixers would permit an estimated $755,000 capital cost saving for a plant to manufacture 4,000,000 pounds per month of a single-base propellant (an approximate 39% saving in equipment cost for mixing through graining operations) and mill cost savings of $1.43 per 100 pounds of propellant to operate this plant. Use of 150-gallon Beken mixers would permit an estimated $2,500,000 capital cost saving for a plant to manufacture 3,000,000 pounds per month of triple-base propellant (an approximate 63% saving on equipment cost for mixing area), and some minor savings in mill costs.

Pitman-Dunn Labs., Div., Frankford Arsenal, Philadelphia, Pa.
ARMOR-PIERCING STEEL PROJECTILES: MECHANICAL PROPERTIES, by R. F. Hehemann (Case Inst. of Tech.) and J. G. Kerr (Lehigh U.). Sep 58, 90p. 95 refs. Rept. R-910.
Order from LC mi$4.80, ph$13.80 PB 144 041

Mechanical properties of steels, particularly those of armor piercing projectiles, and the principal mechanical tests (tension, compression, and indentation hardness) which measure the resistance of these steels to plastic deformation are discussed. The relationships between projectile dynamic impact behavior and mechanical properties are shown in terms of correlations with hardness, metallurgical history, and compression tests.

Polytechnic Inst. of Brooklyn, N. Y.
ANALYSIS OF CENTRAL FORCE SYSTEMS IN THE PRESENCE OF SMALL DISTURBING FORCES, by Frederick V. Pohle and Peter Feitis. Rept. on Contract DA 30-069-ORD-2346. June 59, 39p. 12 refs. PIBAL rept. no. 498; AD-226 187.
Order from LC mi$3.00, ph$6.30 PB 144 075

General theorems which relate to central force systems are presented and the effects of drag are included. Perturbation methods of solution are indicated in terms of dynamical invariants and energy equations are given for the cases of disturbed motion. The hodograph representation is used to supplement the discussion.

Watertown Arsenal Labs., Mass.
BUCKLING OF THIN TRUNCATED CONICAL SHELLS SUBJECTED TO UNIFORM EXTERNAL PRESSURE, by P. P. Radkowski. May 58, 28p. 8 refs. Technical rept. 893.3/1.
Order from LC mi$2.70, ph$4.80 PB 143 838

The buckling of simple supported, thin, conical shells subjected to uniform pressure is analyzed in this report. Predicted critical pressure curves are presented in Figures 3 through 9 for various base angles. In using the critical pressure curves for design purposes, it is suggested that the comparison between the predicted results and known experimental values in Figure 11 be taken into consideration.

Ship Building

George Washington U., Washington, D. C.
ELECTRONICS AND ORDNANCE USAGE DATA FOR NINE SUBMARINES, by Henry Solomon, Raymond Lewis, and Marvin Denicoff. Rept. on Logistics Research Project, Contract Nonr-761(05). 15 Jan 59, 13p. 1 ref. Serial T-97/59.
Order from LC mi$2.40, ph$3.30 PB 144 403

Maritime Administration [Washington, D. C.]
RATPROOFING OF SHIPS, by Stevens and Wood, Inc., New York. July 59, 73p. 58 refs.
Order from OTS $1.50 PB 161 019

The ratproof construction of a vessel is accomplished by so designing and building it as to eliminate, or to render inaccessible to rats, every space which might afford them harborage to shelter, nest, breed or obtain food. This manual was developed to assist shipyards, Naval Architects, Inspectors and others in designing and constructing a ship which will meet the present ratproofing requirements of the U. S. Public Health Service. Acceptable details for ratproofing are not necessarily limited to the details in this manual.

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Food

Iowa Agricultural Experiment Station, Ames.
STORAGE LIFE OF FRESH, CURED AND PROCESSED MEATS, by John C. Ayres. Rept. no. 36 (Termination) for 16 Mar 53-15 June 54 on Contract DA 44-109-qm-1423. [1954] 29p. 58 refs. File no. M-608.
Order from LC mi$2.70, ph$4.80 PB 144 058

This investigation was divided into three phases. Phase I concerned itself with the development of methods and media to be used in the determination

and characterization of the number and kinds of organisms isolated from fresh, cured and processed meats. Phase II was directed primarily toward the characterization of the organisms isolated from the meats. Species representative of each of the several distinct groups encountered were identified. Phase III was directed to the investigation of the microbiological changes accompanying storage of meats at various time-temperature relationships. Organoleptic changes, moisture loss and changes in pH were recorded. An attempt was made to relate the changes in the number and types of organisms in and on the meat to other changes which occur in the meat.

Quartermaster Food and Container Inst. for the Armed Forces, Chicago, Ill.
FOOD FROM ALGAE: A REVIEW OF THE LITERATURE, by John Lavery and Robert G. Tischer. Oct 58, 32p. 124 refs. Library Bulletin no. 1; AD-206 502.
Order from LC mi$3.00, ph$6.30 PB 138 412

The manuscript was completed in August of 1956 and is here presented without change because as it stands it constitutes an important and basic summary of what was known about algae culture at that time. Some of the titles which have appeared since will be listed in a bibliography on space feeding to appear in the September 1958 issue of FOOD TECHNOLOGY.

Whirlpool Corp., St Joseph, Mich.
EVALUATION OF SHELF LIFE OF IRRADIATED FOOD, by Aaron L. Brody. Rept. no. 8 (Final) for 12 July 56-11 July 58. [1958] 72p. 6 refs. QFCIAF File S-718.
Order from LC mi$4.50, ph$12.30 PB 144 183

Storage characteristics of several foods which had received pasteurizing doses of ionizing radiations and had been stored at refrigerator temperatures were studied. Foods studied were: Frankfurters, raw oysters, strawberries, blueberries, sour cherries, asparagus, snap beans, lima beans, and cauliflower. Several fruits and vegetables including peaches, apples, pears, and tomatoes were given uniform surface doses of irradiation in an effort to suppress mold growth with a minimum of damage to the product. Results, while showing trends toward mold growth retardation, were inconclusive.

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Engines and Propulsion Systems

Bell Aircraft Corp. [Buffalo, N. Y.]
A HIGH-SPEED AND HIGH-RESOLUTION PHOTOGRAPHIC TECHNIQUE FOR THE OBSERVATION OF PROPELLANTS INJECTED INTO A FIRING COMBUSTION CHAMBER, by Theodor G. Rossmann. Technical note on Contract AF 49(638)260. 18 May 59, 50p. 20 refs. Rept. no. 8007-981-008, Pt. 1; AFOSR-TN-59-8; AD-208 304.
Order from LC mi$3.30, ph$7.80 PB 143 902

Objective is to "conduct research in the general field of Observation of Burning Propellants in Rocket Engines", for the purpose of obtaining design criteria for liquid propellant rockets which will permit a more rational approach to design of rocket engines. An experimental method has been developed employing high-speed and magnifying photographic techniques. The light of a high intensity source, flashing at rates up to 10,000/sec, is directed through two windows in opposite walls of a rocket combustion chamber. It produces, by means of a photographic objective, a series of up to ten consecutive magnified shadow pictures of the liquid core of the evaporating or burning propellant droplets and ligaments on a photographic film. Evaluation of these films enables one to follow the time history of the physical phenomena mentioned before which occur in a firing rocket combustion chamber.

Bell Aircraft Corp. [Buffalo, N. Y.]
A HIGH-SPEED AND HIGH-RESOLUTION PHOTOGRAPHIC TECHNIQUE FOR THE OBSERVATION OF PROPELLANTS INJECTED INTO A FIRING COMBUSTION CHAMBER, by Theodor G. Rossmann. Technical note on Contract AF 49(638)260. 18 May 59, 88p. Rept. no. 8007-981-008, Pt. 2; AFOSR-TN-59-8; AD-208 304.
Order from LC mi$4.80, ph$13.80 PB 143 915

This section of report is exclusively photos involved in the project and must be used in conjunction with Part 1, PB 143 902)

James Forrestal Research Center, Princeton, N. J.
A COOPERATIVE PROGRAM OF FUNDAMENTAL RESEARCH AS RELATED TO JET PROPULSION. Semi-annual progress rept. for 1 Apr-30 Sep 57 on Project Squid, Contract N6ori-105(03). 1 Oct 57, 129p. 101 refs. AD-146 061.
Order from LC mi$6.30, ph$19.80 PB 137 703

(See also PB 130 671)

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EVALUATION OF PROTECTIVE COATINGS FOR MOLYBDENUM NOZZLE GUIDE VANES, by John R. Giancola. Rept. for Jan 54-Jan 57 on Metallic Materials. June 59, 47p. WADC Technical note 58-241; AD-215 442.
Order from OTS $1.25 PB 151 912

Thirty seven molybdenum nozzle guide vanes, prepared and coated for resistance to jet engine operating conditions, were evaluated in an engine exhaust stream at 1860-1890°F for 4 hours. Non destructive and metallographic examinations revealed the degree of deterioration of each type of coating after test. Results indicate that, in the temperature range of the test, multilayer electrodeposited metallic coatings have the longest service life. No one coating combination survived the test without some serious damage. All coatings tested increased the life of the guide vanes over unprotected molybdenum.

Pennsylvania State U. Coll. of Engineering and Architecture, University Park.
THE FILM VAPORIZATION COMBUSTOR FOR GAS TURBINE ENGINES: THEORETICAL AND EXPERIMENTAL INVESTIGATIONS, by Gunter W. Maybach. Doctoral thesis. Technical rept. on Contract Nonr-656(13). Jan 59, 157p. 34 refs.
Order from LC mi$7.50, ph$24.30 PB 144 371

The objectives of this study were to realize a new combustion principle for gas turbines, one that would inherently reduce the formation of smoke and the formation of deposits inside the combustion chamber; to analyze the mixture formation and combustion mechanisms pertinent to the new combustion principle; and to determine the operational characteristics of a research prototype combustor incorporating the new principle. The new combustion principle is based on the vaporization of the fuel from a liquid film spread along the inner wall surface of a cylindrical combustor section by means of a high-velocity air stream.

Sundstrand Turbo Div., Sundstrand Corp. [Pacoima, Calif.]
SCALING PROCEDURES FOR ROCKETS UTILIZING LIQUID PROPELLANTS OF VARIABLE COMPOSITION AND MIXTURE RATIO, by S. S. Penner. Technical note no. 7 on Contract AF 18(603)107. 31 Aug 59, 20p. 13 refs. S/TD no. 1733; AFOSR-TN-59-908.
Order from LC mi$2.40, ph$3.30 PB 144 012

Generalized scaling rules are derived for liquid-fuel rocket engines on the assumption that the dependence of the overall, effective, conversion time is a known function of propellant mixture ratio and propellant type. The resulting scaling rules provide an important supplementary approach to current programs relating to the development of rational scaling procedures for liquid fuel rocket engines. The present analysis serves to emphasize the importance of continued basic research on the mechanism and rates of combustion reactions in engines.

Manufacturing Equipment and Processes

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
REVIEW OF ELECTRICAL MACHINING METHODS, by Max J. Trzeciak and Francis W. Boulger. 5 Aug 59, 14p. 37 refs. DMIC memo. 28; AD-225 298.
Order from OTS $0.50 PB 161 178

This is a review of recent literature describing the application of electrical machining methods. The three common nonconventional electrical machining methods are the spark-discharge, electrolytic grinding and milling, and arc-discharge methods. Sparking occurs between the tool and workpiece electrodes, which are separated by a dielectric fluid, when the voltage between these electrodes is increased until it exceeds the resistance of the dielectric. The sparking is usually forced to occur at a rate of 20,000 to 300,000 electrical discharges per second. Electrolytic erosion may be considered as an accelerated etching and lapping operation such as that used in preparing metallographic specimens. The metal surface is etched electrolytically and lapped concurrently many times during the course of machining by this method. A rotating metallic (copper or brass) wheel containing abrasive grains imbedded in its surface serves as a cathode. Alternatively, an abrasive wheel impregnated with graphite filler to make it current-conducting can be used. The characteristic of the arc-discharge method is that it thermally erodes the workpiece. The method ordinarily uses a low-voltage, high-amperage direct current power source, although alternating current may be used.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
SPINDLE SHAPING OF TITANIUM SHEET, by Carl T. Olofson. 15 July 59, 4p. 1 ref. DMIC memo. 26; AD-220 196.
Order from OTS $0.50 PB 161 176

Spindle shaping is a hand-fed, edge-profiling operation for certain types of sheet-metal parts. The blank is firmly clamped to a template of desired edge contour. By means of a suitable fixture, the template and blank are then hand fed into an inverted single-spindle cutter protruding through a table. A bearing surface on the milling-type cutter traces the contour of the template, thereby guiding the cutter as it cuts the profile of the part. Parts can be produced from titanium and titanium-alloy sheet with aircraft-quality edge finish. This method is feasible for shaping sheet metal in gages from 0.060 to 0.187 inch using carbide cutters and carbon dioxide as a coolant.

Lockheed Aircraft Corp., Burbank, Calif.
HIGH ENERGY RATE METAL FORMING, by A. F. Watts and Glen N. Rardin. Interim technical engineering rept. no. 6, 1 July-30 Sep 59, on Contract AF 33(600)35543. [1959] 15p. LR-14059.
Order from LC mi$2.40, ph$3.30 PB 144 411

This report describes the preliminary planning for testing explosive forming on aircraft parts.

Princeton U., N. J.
BENEFICIATION OF UNITED STATES MANGANESE RESERVES, by Oskar Morgenstern. Technical rept. no. 1 on Economics Research Proj., Contract Nonr-1858(02). 15 Jan 57, 54p. 71 refs. AD-147 123.
Order from LC mi$3.60, ph$9.30 PB 138 418

Domestic Mn ore and slag reserves: Oxide and carbonate ores (Cuyuna Range, Chamberlain Region, and Artillery Peak); and silicate ores and slags (Aroostook County and open hearth slags). Mn ore beneficiation processes: Oxide and carbonate ores (Chemical processes include ammonium carbamate-carbonate leach, H_2SO_4 and related compounds leach, HNO_3 leach (Nossen), HCl leach (King), and electrolysis; while physical processes include flotation, heavy media seperation and tabling, and crushing and jigging); silicate ores and slags (pyrochemical processes include lime clinkering (Sylvester), lime clinkering-carbamate leach (Sylvester-Dean), chemical roasting (Bruce Williams), and chlorine vaporization; pyrometallurgi-

cal processes include selective oxidation of slag-spiegel (Bureau of Mines), electric furnace reduction (Udy), and selective oxidation of pig iron (Wright); and the high-intensity-arc physical process). Alloy production methods: Ferromanganese (blast furnace and electric furnace); and silicomanganese. Characterization of physical input coefficients and dollar cost data.

Springfield Armory, Mass.
PREPARATION OF A PRECOAT FOR INVESTMENT CASTING, by G. Pributsky and W. M. Kisner. Rept. on The Application of Cast Materials and Processes to the Manufacture of Small Arms Weapons. 22 Oct 58, 21p. Rept. SA-TR18-1066; AD-225 972L.
Order from LC mi$2.70, ph$4.80 PB 144 055

A study was conducted to obtain data in order to establish a standard precoat formulation for use in precision investment castings. One precoat formulation with a sodium silicate binder had superior properties.

Transport, Traction and Hoist Facilities

Army Engineer Research and Development Labs., For Belvoir, Va.
ENGINEERING TESTS OF THE BRIDGE, FLOATING ALUMINUM LIGHT TACTICAL, PONTON BOAT CRADLE, by Gerard J. Welch. 18p. 2 refs. Technical rept. 1584-TR.
Order from LC mi$2.40, ph$3.30 PB 144 151

Requirements for a versatile cradle capable of supporting eight or less aluminum pontons on standard, general-purpose transportation equipment. Design of a Light Tactical Ponton Bridge Cradle, a 600-pound welded steel, skeleton pallet, designed to carry a maximum load of eight pontons nested in an inverted position on a 2 1/2-ton basic-utility trailer.

Land Locomotion Research Branch, Ordnance Tank Automotive Command, Center Line, Mich.
EVALUATION OF VEHICLE SINKAGE IN OFF THE ROAD LOCOMOTION, by M. G. Bekker. June 58, 53p. 4 refs. Rept. no. 35.
Order from LC mi$3.60, ph$9.30 PB 143 949

The problem presented in this paper is to outline the solutions pertaining to vehicle sinkage, and to illustrate them with practical examples in order to assist the user and designer in the application of the latest developments of land locomotion mechanics. The present report has been prepared to provide information which may aid in the design and evaluation of wheeled and tracked vehicles.

Midwest Applied Science Corp., Lafayette, Ind.
BEHAVIOR OF A LINEAR ONE DEGREE OF FREEDOM VEHICLE MOVING WITH CONSTANT VELOCITY ON A STATIONARY GAUSSIAN RANDOM TRACK, by J. L. Bogdanoff and Frank Kozin. Rept. on Contract DA 33-008-ORD-1738. Feb 59, 33p. 6 refs. Rept. no. 48.
Order from LC mi$3.00, ph$6.30 PB 144 233

A method for analyzing a linear one degree of freedom vehicle when excited by a weakly stationary random process is discussed. If the surface of rough terrain is a Gaussian random process, this method can then be applied to determine the motion characteristics of the vehicle. A solution of the power required to maintain a constant velocity is presented.

Rome Air Development Center, Griffiss AFB, N. Y.
EVALUATION OF SURGE-TYPE BRAKE SYSTEM, by Harold Nares. July 59, 21p. RADC-TN-59-138; AD-214 494.
Order from LC mi$2.70, ph$4.80 PB 144 082

A qualitative analysis was made of an automatic trailer-brake system proposed for use in Project Two Wheels which is considered worthy of consideration for use in other military trailer systems. Although there was no attempt made in the reported test program to compile a strict engineering evaluation, sufficient work was done to indicate that the brake system shows considerable merit and that this could profitably become the subject for a funded engineering investigation.

Rome Air Development Center, Griffiss AFB, N. Y.
PROJECT TWO WHEELS, by John J. Guba. Aug 59, 29p. RADC-TR-59-38; AD-212 071.
Order from LC mi$2.70, ph$4.80 PB 144 299

Project Two-Wheels is a series of highly mobile, air-transportable communications and navigational facilities, developed for Airways and Air Communications Service, to support air operations under emergency or austere conditions. The five original facilities were developed by integrating standard communications and navigation equipment with a trailer van specifically designed for the purpose of forming a complete operating system. These facilities are described with primary emphasis on the development in the mechanical area.

MATERIALS

Bockamöllan, Brösarps Station (Sweden).
STATISTICAL EVALUATION OF DATA FROM FATIGUE AND CREEP-RUPTURE TESTS. PART I. FUNDAMENTAL CONCEPTS AND GENERAL METHODS, by Waloddi Weibull. Rept. for 1 Mar 58-28 Feb 59 on Materials Analysis and Evaluation Techniques, Contract AF 61(514)1208. Sep 59, 80p. 19 refs. WADC Technical rept. 59-400, Pt. 1.
Order from OTS $2.00 PB 161 297

Fatigue tests are classified into three types with consideration to the appropriate method of evaluating

the data. Fundamental statistical concepts, general methods, and useful tools are presented. The possibilities of estimating distribution parameters have been examined. Starting from the concept of information available in a sample, various methods of extimating the parameters of location, scale, and shape are discussed, completed by a comparison of the efficiency of various estimates. General principles of fitting curves to observations are outlined and applied to the methods of maximum likelihood, linear regression, and best linear estimators.

Michigan U. Research Inst., Ann Arbor.
THE PHOTOGRAPHIC SEQUENCE EFFECT, by J. H. Enns and Ernst Katz. Final rept. pt. 2 on Contract AF 49(638)69. Aug 59, 23p. 5 refs. 2613-9-F; AFOSR-TR-59-122.
Order from LC mi$2.70, ph$4.80 PB 144 152

In Section 1 the motivation of this study is given; In Section 2 the method of sequence exposures is briefly described experimentally and theoretically and the experimental results are described. The results confirm qualitatively the trend of the theoretical work but lead to quantitative difficulties, which are discussed in Section 3. The conclusions are summarized in Section 4.

Metals Processing Lab., Mass. Inst. of Tech., Cambridge.
CHROMIUM COATINGS FROM LIQUID METAL SOLUTIONS, by Peter Schwarzkopf, Ernst B. Weglein and John Wulff. Technical rept. on Contract Nonr-1841(30). Dec 58, 31p. 12 refs.
Order from LC mi$3.00, ph$6.30 PB 143 984

Three types of solid-liquid interface are found to form by continuous cooling of a saturated solution of chromium in tin below the liquidus temperature. It was found possible to produce circa 0.001 inch coatings of chromium which are soft, dense and relatively smooth. Such coatings are too thin to offer protection to molybdenum above about 900°C in air. The .001 inch chromium deposits offer some promise as a barrier substrate for spray coats. (See also PB 151 126)

Virginia Agricultural Experiment Station, Blacksburg.
QUALITY CONTROL METHODS FOR SEVERAL RELATED VARIABLES, by J. Edward Jackson. Technical rept. no. 4 on Development of Statistical Methods for Experimental Designs in Quality Control and Surveillance Testing, Contract Nonr-2352(01). Dec 58, 31p. 7 refs.
Order from LC mi$3.00, ph$6.30 PB 143 925

Ceramics and Refractories

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
GLASS-BONDED REFRACTORY COATINGS FOR IRON- OR NICKEL-BASE ALLOYS, by T. E. Cook and B. W. King. 25 Apr 59, 19p. 40 refs. DMIC memo. 16.
Order from OTS $0.50 PB 161 166

Ceramic coatings are applied to metal to (1) prevent oxidation, corrosive attack or erosion, and (2) thermally insulate the metal or change the radiation characteristics of the surface. To be effective, they must be continuous and bond tightly to the metal. Some do not adhere to the metal directly but require an intermediate undercoat. The quality of the coating material, (2) preparation of the metal surface, and (3) application and firing procedures used to obtain a bond between the metal and the glassy coating. Enamels are mixtures of oxides smelted into glasses and fritted by quenching--usually in water. Metals are prepared for coating by degreasing, sand blasting, scouring, pickling or combinations of these methods. The enamel frit is milled with water (and sometimes small amounts of conditioning agents) to form a slip or suspension, similar in appearance to water-base paints, of fine frit particles in water. The slip is applied to the metal by dipping or spraying as uniformly as possible. The coated piece is dried to remove water, sometimes baked at 300 to 600 F, and fired for 4 to 10 minutes at temperatures ranging from 1600 to 2400 F. Recommended coatings for iron- and nickel-base alloys, coating compositions, and details of procedures for metal preparation and application are given.

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
CREEP TESTS ON GRAPHITE. 23 June 50, 4p. NEPA 1480.
Order from LC mi$1.80, ph$1.80 PB 144 024

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
ZIRCONIA, by George Hall. 4 Mar 42, 57p. 21 refs. NEPA 437-IHR-E12.
Order from LC mi$3.60, ph$9.30 PB 144 025

Watertown Arsenal Labs., Mass.
THE SPECTRAL EMISSIVITY AND TOTAL NORMAL EMISSIVITY OF GRAPHITE AT ELEVATED TEMPERATURES, by Albert F. Grenis and Albert P. Levitt. Nov 59, 17p. 11 refs. Technical rept. no. WAL TR-397.1/2.
Order from LC mi$2.40, ph$3.30 PB 144 329

Apparatus developed for measuring the spectral and total normal emissivity of electrically conducting refractory materials. The total normal emissivities and spectral emissivities, at an effective wavelength of 0.65 microns, were determined for machined surfaces of graphite. The spectral emissivities were investigated within the range of 1000°C to 3000°C.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF AN INDICATOR TEST PAPER TO DETECT INSTABILITY OF STORED PROPELLANTS, by Phillip Rochlin. Nov 58, 32p. 7 refs. Technical rept. 2567; AD-202 006.
Order from LC mi$3.00, ph$6.30 PB 138 349

To evaluate the abilities of 3 experimental propellant test papers to detect incipient instability in stored propellants.

General Electric Co., Schenectady, N. Y.
FUEL TRANSIENT TEMPERATURE AND PRESSURE DUE TO AERODYNAMIC HEATING, by W. W. Fischer. Rept. on Project Hermes. Dec 50, declassified 17 Mar 58. 38p. Technical Information Series DF 50A0521.
Order from LC mi$3.00, ph$6.30 PB 144 123

An analysis was made of the effect of aerodynamic heating upon the Hermes B-1 fuel temperature and pressure. Both the annular and island fuel tanks were considered for 3 sets of conditions, viz., no insulation on either tank, insulation on diffuser side of island tank and insulation on diffuser side of both tanks. Calculation results indicate that this system of pressurization is unsatisfactory. Without insulation the fuel temperature becomes too high and a low pressure occurs shortly after B-1 launching. Insulation keeps the fuel cool enough but then the fuel pressure is so low that an auxiliary means of pressurization is necessary to prevent fuel pump cavitation.

General Electric Co., Schenectady, N. Y.
PREPARATION OF DIBORANE BY REACTION OF LITHIUM HYDRIDE AND BORON HALIDES: USE OF TETRAHYDROFURAN AS A SOLVENT, by E. M. Boldebuck and J. R. Elliot. Rept. on Proj. Hermes. Dec 49, 6 refs. Rept. no. R49A0534.
Order from LC mi$1.80, ph$1.80 PB 144 391

Tetrahydrofuran has been found to be an efficient solvent for diborane, and its use as a solvent in the lithium hydride-boron halide reaction results in good yields of diborane in the absence of catalyst or special operating temperatures.

General Electric Co., Schenectady, N. Y.
PREPARATION OF DIBORANE BY THE REACTION OF LITHIUM HYDRIDE AND BORON FLUORIDE ETHERATE, by J. R. Elliott and F. F. Roedel. Rept. on Proj. Hermes. 18 Feb 48, declassified 11 Aug 49, 54p. 9 refs. Rept. no. TR-55251.
Order from LC mi$3.60, ph$9.30 PB 144 393

A fundamental investigation of the reaction of lithium hydride and boron fluoride etherate in ethyl ether to form lithium fluoride and diborane has been performed under rigidly controlled conditions. Under rigidly controlled anhydrous conditions, no induction period precedes the reaction between lithium hydride and boron fluoride. A method has been found for the elimination of induction periods. This method involves pretreatment of lithium hydride in ether with diborane immediately before addition of the boron fluoride etherate.

General Electric Co., Schenectady, N. Y.
SOLUBILITY OF DIBORANE IN ETHYL ETHER AND IN TETRAHYDROFURANE, by E. M. Boldebuck, J. R. Elliott and others. Rept. on Proj. Hermes. 19 Nov 48, declassified 11 Aug 49, 11p. Rept. no. TR-55288.
Order from LC mi$2.40, ph$3.30 PB 144 395

The pressure over a solution of diborane in ethyl ether and in tetrahydrofurane has been measured in a bomb at different temperatures. From these data the solubility of diborane at 20°C and diborane pressure of one atmosphere has been calculated as 1.1 g. per 100 g. ethyl ether, 8.1 g. per 100 g. tetrahydrofurane. Solubility of diborane in ethyl ether is proportional to pressure and slightly higher than predicted by Raoult's law. In tetrahydrofurane solubility increases as the square root of diborane pressure, suggesting the formation of a complex with the solvent. Molar heat of solution of diborane in ethyl ether has been calculated, roughly, as -2800 cal; in tetrahydrofurane as -4900 cal.

Michigan U. Research Inst., Ann Arbor.
THERMAL CONDUCTIVITY OF LUBRICATING OILS AND HYDRAULIC FLUIDS, by D. W. McCready. Rept. for 1 July 58-30 June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5745. July 59, 32p. 12 refs. WADC Technical rept. 59-185.
Order from OTS $1.00 PB 161 040

An all-metal concentric cylinder type of thermal conductivity cell was used to measure the thermal conductivity of twelve natural and synthetic base lubricating fluids. Thermal conductivity values in the temperature range of from 70 to 500°F are reported for fluids considered stable to the higher temperature. The maximum temperatures for other fluids were limited by their instabilities under test conditions. Since each fluid has individual characteristics, no correlation of conductivity values appears possible. Values are considered precise and for possible correlation can be compared to those of a fluid chosen as a "standard reference."

Naval [Weapons Plant] Washington, D. C.
PROPERTIES OF DIMETHYL POLYSILOXANE FLUIDS, by S. H. Cole. 23 Dec 58, 9p. 1 ref. NGF-T-34-58; NAVORD rept. 6488.
Order from LC mi$1.80, ph$1.80 PB 144 119

Tests were conducted to determine properties of dimethyl polysiloxane fluids in the viscosity range 0.65 to 214,000 centistokes. These properties included viscosity, viscosity-temperature coefficient, pour point, flash point, specific gravity, refractive index, dielective constant, acid number and volatility of the more viscous grades. A military specification was prepared from the data obtained from these tests.

Rocket Research Lab., Ohio State U. Research Foundation, Columbus.
INVESTIGATION OF LIQUID NITRIC OXIDE AS A ROCKET OXIDIZER, by Loren E. Bollinger and Rudolph Edse. Rept. on Contract AF 33(616)5615. May 59, 29p. 6 refs. WADC Technical rept. 59-12; AD-208 327.
Order from OTS $0.75 PB 161 300

An experimental investigation has been made of the use of liquid nitric oxide as an oxidizer for rocket engines. Since nitric oxide is an endothermic compound, it follows from thermodynamic calculations that nitric oxide - fuel mixtures have a higher specific thrust than do corresponding oxygen-fuel mixtures. It was found that extremely long residence times were required for the propellant in the combustion chamber. Originally it was planned to use JP-4 as the fuel with liquid nitric oxide but methyl alcohol was substituted because of the difficulties encountered in burning JP-4 with liquid nitric oxide. From the limited experiments which were conducted, liquid nitric oxide does not appear favorable as an oxidizer for rockets because of the long residence time required for nitirc oxide to react fully with the fuels used. Most of the experiments were conducted with a nominal 50-pound thrust motor having a characteristic length of 1515 inches; the design chamber pressure was 300 pounds per square inch. An experimental, uncorrected value of 211 seconds was obtained for the specific thrust at a chamber pressure of 327 pounds per square inch for an oxidizer-to-fuel weight ratio of 1.46. In addition, the results of these studies showed that nitric oxide, which is one of the important intermediate products in the combustion of the various nitric-acid type oxidizers, may affect the smooth combustion of nitric acid with a fuel because of the long chemical reaction time of nitric oxide.

Shell Development Co., Emeryville, Calif.
FUNDAMENTALS OF GEAR LUBRICATION, by V. N. Borsoff and R. Lutwack. Final rept. for June 55-May 56 on Contract NOas 53-356-c. [1956] 101p. 8 refs. Rept. no. S-13694; AD-143 172.
Order from LC mi$5.70, ph$16.80 PB 137 817

The extreme pressure film established on the working surfaces of gear teeth becomes gradually attrited when the gears are operated with an unreactive oil. The rate of attrition is high in the beginning of operation with unreactive oil. The rates of attrition decreased with time. Approximately 2/3 of the extreme pressure film could be attrited, and 1/3 remains firmly attached to the surfaces. Rolling motion has little effect on the attrition of an extreme pressure film. When gears with an extreme pressure film on the tooth working surface are operated with an unreactive oil in the thick film zone of lubrication, the mechanism of attrition is primarily that of "washing" by the lubricant. The shifting of the peaks of the extreme pressure film in the direction of sliding suggests a plastic like nature of the E. P. film formed by dibenzyl disulfide compounded oil. When gears with a radioactive E. P. film established on the teeth working surfaces are operated with an inert E. P. compound oil (DBDS in this case), the exchange of atoms of the active ingredient (sulfur) or molecules of the resultant product of reaction (iron-sulfide) in the extreme pressure film is a continuous process. This confirms our previous conclusion that extreme pressure films are being continuously formed and attrited during the operation of gears. The results of the tests with tagged DBDS performed last year confirm well the results of the two previous years of investigations.

Springfield Armory, Mass.
EVALUATION OF SHELL FOUR-BALL TEST RESULTS ON VARIOUS CUTTING FLUIDS AND LUBRICANTS, by L. Krasnor. Partial rept. no. 1, 2 Mar 59, 30p. Rept. SA-TR16-1055.
Order from LC mi$2.70, ph$4.80 PB 144 130

Measurements are given of the extreme pressure properties of more than 110 cutting fluids and lubricants taken in accordance with Federal Standard VV-L-791e, Method 650.3, with Shell Four-Ball Extreme Pressure Lubricants Tester. Highest Mean Hertz Load values were obtained from tests of blended materials of multiple compounding containing sulfur, chlorine, or phosphorus. Three of the four additives tested, which were used with mineral seal oil as a diluent, showed improved performance over their use with 100 second viscosity mineral oil. Adequate explanation for this is not yet available. Copper powder, cuprous chloride, and copper oleate showed some degree of extreme pressure activity especially in conjunction with sulfur and sulfur compounds.

Leather and Textiles

Cornell U., Ithaca, N. Y.
MASS TRANSFER COOLING OF PARACHUTE MATERIALS, by Rodney H. Cornish, Franklin J. Ahimaz, and others. Rept. for June 58-Jan 59 on Parachute Materials and Functional Textiles, Contract AF 33(616)5852. Sep 59, 97p. 7 refs. WADC Technical rept. 58-684.
Order from OTS $2.25 PB 161 293

Seventy-three tests were made on different parachute ribbon materials and protective coatings. These tests were conducted at Mach 5, pressure altitude of 100,000 feet and stagnation temperatures of 700 to 900°F. Most of the effort was devoted to mass transfer cooling (sublimation and melting). Hexachloroethane, Chloro-anthraquinone, Methyl-anthraquinone, Hydroxy-anthraquinone, and Camphene were applied by various techniques in several thicknesses. The results of these tests are plotted in the form of: lifetimes parameterized in terms of coating weight, temperature profiles, and heating rates. Tabular data is presented for all of the runs. This data indicates that coating weights on the order of the weight of the ribbons are required to give significant protection at the test conditions and that mechanical protection must be provided to the coatings to improve their efficiency.

Quartermaster Research and Engineering Center, Natick, Mass.
MEASURING AND PREDICTING THE GENERATION

OF STATIC ELECTRICITY IN MILITARY CLOTHING, by Aldo M. Crugnola and Horace M. Robinson. Sep 59, 71p. 44 refs. Textile Series rept. no. 110. AD-225 497.
Order from LC mi$4.50, ph$12.30 PB 143 888

The study reported in the following pages represents a review of the problem presented by static generation in clothing, and an exploration of the methods by which the problem can be minimized and the generation of a charge be evaluated on a clothing system. An investigation is reported on the effectiveness and durability of 12 antistatic finishes on various fabrics, and one finish is pinpointed which possesses the best combination of effectiveness and durability. From a review of published instrumental methods by which the electrostatic behavior of a fabric may be assessed, it was concluded that none of these is capable of giving an adequate, quantitative forecast of the hazard inherent in a particular multi-layer system. For this purpose, an instrument has been developed and is described herein. Results obtained with this instrument agree with those obtained from "on-the-individual" type test.

Plastics

Army Engineer Research and Development Labs., Fort Belvoir, Va.
GENERAL FORMULA FOR CREEP AND RUPTURE STRESSES IN PLASTIC MATERIALS, by S. Goldfein. 31 July 58, 40p. 14 refs. Rept. no. 2409-17.
Order from LC mi$3.00, ph$6.30 PB 144 044

The purpose of this work was to derive a general formula which would accurately describe the time-temperature relationship for creep and rupture stresses in plastic materials.

Brown U. Div. of Engineering, Providence, R. I.
THE VALIDITY OF MODEL REPRESENTATION FOR LINEAR VISCOELASTIC BEHAVIOUR, by H. Kolsky and Y. Y. Shi. Technical rept. no. 5 on Contract Nonr-562(14). Jan 58, 43p. 27 refs. AD-156 118.
Order from LC mi$3.30, ph$7.80 PB 137 917

The observed mechanical response of some linear viscoelastic materials as measured by Lethersich and others is compared with the response predicted by two and three parameter models. It is found that two parameter models are completely inadequate in describing the observed behavior over even a narrow frequency range. Of the two three-parameter models the standard linear solid is preferable, and this model gives at least qualitative agreement with experiment over a frequency range of one or two decades. It is shown that this degree of agreement is adequate to predict the mechanical behavior of the materials when subjected to smooth stress or strain cycles quasi-statically.

Frick Chemical Lab., Princeton U., N. J.
EXISTENCE OF A SHARPLY DEFINED MAXIMUM RELAXATION TIME FOR MONODISPERSE POLYSTYRENE, by A. V. Tobolsky and K. Murakami. Rept. on Contract Nonr-1858(07). 29 Jan 59, 31p. 8 refs. ONR Technical rept. RLT-28.
Order from LC mi$3.00, ph$6.30 PB 144 144

Relaxation of stress measurements were carried out in the region of rubbery flow on two samples of polystyrene.

Rubber and Elastomers

Frick Chemical Lab., Princeton U., N. J.
THE MECHANISM OF OXIDATIVE SCISSION IN NATURAL RUBBER, by A. V. Tobolsky and A. Mercurio (Doctoral thesis). Rept. on Contract Nonr-1858(07). 29 Dec 58, 24p. 22 refs. ONR Technical rept. RLT-27.
Order from LC mi$2.70, ph$4.80 PB 143 853

The free radical producers 2-azobisisobutyronitrile, di-t-butyl peroxide, and benzoyl peroxide, have been used to initiate the oxidation of natural rubber in dilute benzene solutions at 60-80°C. Quantitative comparisons are made between the measured rate of scission of natural rubber and the known rate of initiation of oxidation chains (in the kinetic sense) by these agents under these conditions. The rate of rubber scission in dilute benzene solutions and in solid rubber has been used to investigate the ability of the systems tetramethyl thiuram disulfide and benzoyl peroxide-dimethyl aniline to initiate oxidation chains. The rates of initiation in both cases depend strongly on rubber concentration approaching, in solid rubber, values comparable to the rates of initiation of polymerization by these agents in bulk styrene and bulk methyl methacrylate.

Rock Island Arsenal Lab., Ill.
EVALUATION OF POTENTIAL AGE RESISTING INHIBITORS FOR SBR 1600 VULCANIZATES, by D. Ilten. 2 Nov 59, 21p. 8 refs. Rept. no. 59-2825.
Order from LC mi$2.70, ph$4.80 PB 144 335

Previous work had indicated that certain organo metallic compounds formed in situ during the vulcanization of rubber were very effective in improving the age resistance of the rubber. This work was done to evaluate related members of this class as antioxidants in order to determine the degree of protection obtained and if possible to find a better antioxidant. It was found that the residues formed during curing in both the sulfur-accelerator cure and a cure based on the use of accelerators only were more effective as antioxidants than any of the potential inhibitors which were evaluated. In all cases investigated, the age resistance of the accelerator cured vulcanizates was superior to that of the corresponding sulfur-accelera-

tor cured vulcanizates. Some of the compounds evaluated made the age resistance of the vulcanizates poorer than that of the control. This was considered to reflect their activity as vulcanization accelerators even at the relatively low aging temperatures.

Rock Island Arsenal, Ill.
SYNTHESIS OF RUBBER COPOLYMERS BY SOME NEW METHODS, by W. Jurgeleit and R. R. Freeman. 28 July 59, 15p. 4 refs. Rept. no. 59-2001. AD-226 101.
Order from LC mi$2.40, ph$3.30 PB 143 885

The copolymerization of butadiene and styrene by Ziegler catalysts was investigated. An adsorption process as the time determining step is suggested in the Ziegler polymerization. Grafting by means of an anionic initiator was accomplished in concentrated solutions and in a solvent free process on a roll mill. The catalyst, Na alcoholate, was prepared from Na or NaH dispersions and an alcohol. It is essential first to bring the Na or NaH dispersions together with the polymer under conditions that might allow at least a partial reaction of the polymer with Na, either substitution or addition. Furthermore, the catalyst must be prepared in the presence of both the monomer and the polymer. The described method was used to graft (a) acrylonitrile onto polybutadiene and a butadiene/styrene copolymer, and (b) styrene onto polybutadiene and a butadiene/acrylonitrile copolymer. The graft copolymers were identified by solubility changes and IR spectra. The solvent free grafting procedure might have some technical possibilities and shows certain advantages when compared with similar methods known to date.

MATHEMATICS

Applied Mathematics and Statistics Lab., Stanford U., Calif.
ON CENTERING INFINITELY DIVISIBLE PROCESSES, by Ronald Pyke. Technical rept. no. 24 on Contract Nonr-225(21). 8 Jan 59, 13p. 10 refs.
Order from LC mi$2.40, ph$3.30 PB 144 291

The concept of centering stochastic processes having independent increments, introduced by Lévy, is applied to processes having both stationary and independent increments. The question of what centering functions preserve the stationarity of the increments is studied.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
ON THE GAUSS CURVATURE OF MINIMAL SURFACES, by Robert Osserman. Technical rept. no. 11 on Contract DA 04-200-ORD-704. 18 Aug 59, 26p. 12 refs. OOR rept. 1323.16-M.
Order from LC mi$2.70, ph$4.80 PB 144 333

The majority of results in this paper are derived from the following observation. Given a point p on a minimal surface, one may assign to each point of a suitable neighborhood N of p two complex variables ξ and w, such that the correspondence between ξ and w is analytic, and for the Gauss curvature K at each point of N we have the formula

$$K = -\left[\frac{4}{(1+|w|^2)^2}\left|\frac{dw}{d\xi}\right|\right]^2$$

This allows us to translate elementary properties of analytic functions into geometric statements about minimal surfaces.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
THE REPRESENTATIONS OF LINEAR FUNCTIONALS BY MEASURES ON SETS OF EXTREME POINTS, by Errett Bishop and Karel Deleeuw. Technical rept. no. 6 on Contract AF 49(638)294. 26 Oct 59, 44p. 11 refs. AFOSR-TR-59-133.
Order from LC mi$3.30, ph$7.80 PB 144 348

The existence of representations of linear functionals on subspaces and subalgebras of a C(X) by measures on "boundaries" smaller than the Silov boundary are discussed.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
STATISTICAL INFERENCE ON TIME SERIES BY HILBERT SPACE METHODS, I, by Emanuel Parzen. Technical rept. no. 23 on Contract Nonr-225(21). 2 Jan 59, 132p. 14 refs.
Order from LC mi$6.90, ph$21.30 PB 144 406

This paper is the first of a series of projected papers on modern time series analysis, in which it is hoped to show how Hilbert space methods (which were introduced in the 1940's to clarify the probabilistic structure of time series) can be used to clarify, and to solve, various problems of statistical inference on time series. In this paper, among other things, we introduce a tool which plays a major role in our work, namely the representation of a stochastic process with finite second moments by means of a reproducing kernel Hilbert space.

[Army] Chemical Corps Engineering Agency, Army Chemical Center, Md.
METHODS OF SAMPLING ACCEPTANCE BY VARIABLES, by David R. Howes and Evelyn J. Leonard. 21 July 53, 32p. 11 refs. Engineering Agency Manual no. 4; AD-51 450.
Order from LC mi$3.00, ph$6.30 PB 144 394

A discussion is given of the uses of variables acceptance in production and acceptance inspection for percent defective. Charts and tables are given of the levels of protection and discrimination afforded by explicit plans. The basic assumptions, operations, and statements of requirements common to all modern variables acceptance systems are presented. The discussion is intended to make clear the use and advantages of variables acceptance procedures. Arguments and examples are furnished to show that variables sampling is able to (1) reduce inspection and save materials, acceptance delay, man hours, and facilities; (2) improve protection to the consumer by decreasing

the risks that isolated lots of inferior material will escape detection, and (3) improve discrimination. The latter implies that the acceptance quality levels can be relaxed to permit faster production, and that rejections can be reduced while maintaining the same protection to the consumer.

Army Chemical Corps Engineering Command, Army Chemical Center, Md.
PROCEEDINGS OF THE ANNUAL STATISTICAL ENGINEERING SYMPOSIUM [NO. 4] 7-8 MAY 1958, by T. M. Vining. [1958] 187p. 102 refs.
Order from LC mi$8.40, ph$28.80 PB 144 138

Contents:
Theoretical aspects of MIL-STD-414
MIL-STD-414 sampling procedures and tables for inspection by variables for percent defective
Practical application of OSTD 80
The use of sample quasi-ranges in estimating population standard deviation
Statistical quality control in the Soviet Union
The relationship of sample size to lot size in acceptance inspection
Evaluation of surveillance sampling plans
An optimal depletion of inventory for known utility functions
Evaluation of surveillance sampling plans
Optimal conditions for LIFO and FIFO inventory systems
A reliability model for the case of dependent components
The role of environmental testing in missile programs
Panel on proposed department of defense handbook on single level continuous sampling
The proposed DOD handbook on procedures and tables for single level continuous sampling inspection by attributes
Field application of single-level continuous sampling
Multi-level continuous sampling plans
Mathematical and statistical principles underlying chemical corps inspection procedures for product verification

[Army Rocket and Guided Missile Agency] Redstone Arsenal, Ala.
DIAGONALIZATION OF OPERATOR MATRICES, WITH APPLICATIONS TO PARTIAL DIFFERENTIAL EQUATIONS, by Ben Fitzpatrick, Jr. 1 Sep 57, 17p. Rept. no. 2R24F; AD-146 524.
Order from LC mi$2.40, ph$3.30 PB 144 194

Using matrix theoretic methods, conditions for reducibility of a first order linear operator matrix have been determined. When a system of partial differential equations has a coefficient matrix L that can be so reduced, the system is readily solvable. While most systems of partial differential equations cannot be solved in this manner, the method gives the solution in closed form when applicable. It is furthermore to be hoped that some of the results obtained will prove useful in matrix theory as such, in addition to the above applications to partial differential equations.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE NUMERICAL SOLUTION OF A FOURTH-ORDER PARABOLIC DIFFERENTIAL EQUATION, by Horace Flatt. Apr 56, 18p. 8 refs. Memo. rept. no. 999.
Order from LC mi$2.40, ph$3.30 PB 144 084

The purpose of this report is to describe a numerical method for obtaining the solution of a boundary-value problem involving a fourth-order parabolic differential equation. This method uses finite differences, and a comparison is made between the numerical solution obtained in this way and the solution as obtained by evaluating the analytical solution.

Minnesota U., Minneapolis.
AN ANALYTIC PROBLEM WHOSE SOLUTION FOLLOWS FROM A SIMPLE ALGEBRAIC IDENTITY, by Glen Baxter. Technical rept. no. 8 on Contract AF 18(603)30. 1 June 59, 25p. 6 refs. AFOSR-[TN]-59-592; AD-217 184.
Order from LC mi$3.70, ph$4.80 PB 143 956

The solution of a particular operator equation involving elements in a Banach algebra is shown to follow directly from an algebraic identity involving the operator. A combinatorial lemma of a rather general nature is proved and then used to show the result above. Applications to probability theory, etc. are considered.

California U., Berkeley.
THE GELFAND-LEVITAN EQUATION APPROACH TO QUESTIONS IN PHASELESS SCATTERING, by S. F. Tuan. Technical rept. no. 22 on Contract Nonr-222(37). Feb 58, 27p. 14 refs. AD-153 848.
Order from LC mi$2.70, ph$4.80 PB 138 138

Contents:
The radial equation for angular momentum, angular momentum $\ell = 0$
The outgoing Eigenfunctions: The scattering operator
The Gelfand-Levitan equation: The weight operator
The Bargmann potentials
ℓ-wave scattering and generalized bargmann potentials

California U., Berkeley.
A GENERAL COHOMOLOGY THEORY OF SHEAVES, by Charles E. Watts. Technical rept. no. 16 on Contract Nonr-222(37). Oct 57, 38p, 9 refs. AD-148 298.
Order from LC mi$3.00, ph$6.30 PB 137 562

California U., Berkeley.
ON THE MORSE-LERAY SPECTRAL SEQUENCE, by S. R. Fary. Technical rept. no. 2 on Contract Nonr-222(62). Nov 58, 18p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 144 315

California U., Berkeley.
WHICH LIE GROUPS ARE HOMOTOPY-ABELIAN? by Ioan James and Emery Thomas. Technical rept. no. 11 on Contract AF 49(638)79. Sep 59, 9p. 12 refs. AFOSR-TN-59-982.
Order from LC mi$1.80, ph$1.80 PB 144 369

We say that a topological group G is homotopy-abelian if the mappings f and $\bar{f}$, of G x G to G, are homotopic, where

$$f(x,y) = xy = f(y,x) \quad (x,y \in G) .$$

The problem we consider in this paper is whether any of the non-abelian Lie groups are homotopy-abelian. Our main result is: Theorem: The classical structure classes contain no Lie group which is homotopy-abelian but not abelian. Our method is a generalization of that used by H. Samelson to show that Sp(1) is not homotopy-abelian.

Duke U., Durham, N. C.
SOME PROPERTIES OF THE FUNDAMENTAL SOLUTION OF THE PARABOLIC EQUATION, by Stewart M. Robinson. Rept. on Contract AF 18(600)1341. July 59, 29p. 15 refs. AFOSR-TN-59-789.
Order from LC mi$2.70, ph$4.80 PB 144 374

Harvard U., Cambridge, Mass.
NOTE ON DEGREE OF APPROXIMATION BY BOUNDED ANALYTIC FUNCTIONS: PROBLEM β, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Oct 59, 24p. 11 refs. AFOSR-TN-59-952; AD-228 076.
Order from LC mi$2.70, ph$4.80 PB 144 472

The present writer has recently published a general result on Problem β , and now wishes to indicate a stronger result. The older result deals with Lipschitz conditions in the hypothesis, while the new one deals with integrated Lipschitz conditions; the latter were introduced into the theory of degree of trigonometric approximation in theorems stated without proof by Hardy and Littlewood and later proved in detail by Quade. The present note is made possible by an investigation on integrated Lipschitz conditions for the complex variable made by Walsh and Russell.

Harvard U., Cambridge, Mass.
ON THE ANALOGUE FOR MAXIMALLY CONVERGENT POLYNOMIALS OF JENTZSCH'S THEOREM, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Dec 58, 24p. 7 refs. AFOSR-TN-58-1086; AD-207 583.
Order from LC mi$2.70, ph$4.80 PB 144 344

Although sequences of rational and analytic functions of the complex variable have been studied in some detail regarding geometric degree of convergence, and convergent sequences of analytic functions have been basically studied with reference to their zeros, no adequate applications to maximally convergent sequence of polynomials as such have been made. In particular there has been no special study of the analogue of Jentzsch's theorem, that every point of the circle of convergence of a Taylor development is a limit point of zeros of the partial sums. The object of the present paper is to investigate specifically the zeros of maximally convergent sequences of polynomials, including in detail some illuminating special expansions.

Harvard U., Cambridge, Mass.
ON THE ASYMPTOTIC PROPERTIES OF EXTREMAL POLYNOMIALS WITH PRESCRIBED CONSTANT TERM, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Oct 59, 16p. 5 refs. AFOSR-TN-59-1037.
Order from LC mi$2.40, ph$3.30 PB 144 368

The object of the present note is to study the analogue of $\lim_{n\to\infty} \|T_n(z)\|^{1/n} = \tau(E)$,

for the polynomials

$$p_n(z) \equiv z^n + a_1 z^{n-1} + \ldots + a_n$$

of least norm where the numbers $a_n = A_n$ are prescribed; under suitable conditions on E we obtain necessary and sufficient conditions on the A_n that the analogue be valid.

[Illinois U., Urbana]
ON THE CONSTRUCTION OF CERTAIN AUTOMORPHIC FORMS OF NON-NEGATIVE DIMENSION, by Marvin Isadore Knopp. Technical rept. on Contract Nonr-1834(18). 1958, 51p. 8 refs.
Order from LC mi$3.60, ph$9.30 PB 144 402

Institute for Advanced Study, Princeton, N. J.
RESEARCH IN ANALYSIS: EXTREME LENGTH, by James A. Jenkins. Final rept. on Contract DA 36-034-ORD-2453. Aug 59, 4p.
Order from LC mi$1.80, ph$1.80 PB 144 028

The work done under this contract has dealt with the method of the extremal metric, the results obtained showing once again the manner in which it provides a unifying principle in the Theory of Functions as well as a powerful method for deriving new results. The range of subjects covered includes quasiconformal mappings, type problems, the trajectories of quadratic differentials and especially the General Coefficient Theorem, its extensions and applications to the theory of univalent functions.

Institute for Advanced Study, Princeton, N. J.
A VARIANT OF HELLY'S THEOREM, by Branko Grünbaum. Rept. on Contract AF 49(638)253. Sep 59, 10p. 18 refs. AFOSR-TN-59-980; AD-228 283.
Order from LC mi$1.80, ph$1.80 PB 144 477

The following modification of Helly's theorem on intersections of convex sets is established, together with some related results. Let K, a subset of Euclidean space, be the union of a finite number of disjoint, compact, convex sets. Then there exists an integer $N = N(K)$ with the following property: For any family $\{K_\alpha\}$, where each K_α is the transform of K by a non-singular affine transformation T_α (depending on α), if any N of the sets K_α have a non-empty intersection, then the intersection of all the sets K_α is not empty. Examples show that none of the underlined conditions may be dropped.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
NEW INEQUALITIES FOR MEMBRANE AND PLATE EIGENVALUES, by L. E. Payne. Rept. on Contract AF 49(638)228. Sep 59, 16p. 5 refs. Technical note BN-186; AFOSR-TN-59-1040; AD-226 856.
Order from LC mi$2.40, ph$3.30 PB 144 292

Two notes are presented on isoperimetric inequalities for membrane and plate eigenvalues. The first give upper and lower bounds for clamped plate eigenvalues in terms of fixed membrane eigenvalues for the same region. The second gives a natural extension of the isoperimetric inequality of Faber and Krahn.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
A THEORY OF LOWER BOUNDS FOR EIGENVALUES, by H. F. Weinberger. Rept. on Contract AF 49(638)228. Aug 59, 99p. 59 refs. Technical note BN-183; AFOSR-TN-59-974.
Order from LC mi$5.40, ph$15.30 PB 144 306

A polynomial equation whose roots are lower bounds for the eigenvalues of a differential operator is derived. The coefficients of the equation depend upon some arbitrary functions and upon the minimal information necessary to determine any lower bounds. Conditions are given under which the lower bounds so obtained converge to the correct eigenvalues as more arbitrary functions are used. The method serves to unify and improve many of the known methods of finding lower bounds.

Institute of Mathematical Sciences, New York U., N. Y.
MATRIX INVERSION AND THE SOLUTION OF LINEAR EQUATIONS, by J. H. Curtiss. Technical rept. no. 5 on Contracts DA 30-069-ORD-1257 and N6ori-201, T. O. 1. Aug 55, 85p. 5 refs. IMM-NYU-220; AD-115 793.
Order from LC mi$4.80, ph$13.80 PB 143 840

There are a number ot other ways in which the basic facts concerning the existence of solutions to systems of linear algebraic equations can be stated. The formulation given has the advantage of telling the story with a minimum amount of technical terminology. Also, it is of interest to mathematical analysts because the existence theorems for integral equations can be given a parallel formulation. The proof of the theorem is constructed in the course of the chapter. At the same time a number of other fundamental results are derived, which are essential for an understanding of the theory of linear computations.

Institute of Tech., U. of Minnesota, Minneapolis.
CONVERGENT SOLUTIONS OF ORDINARY LINEAR HOMOGENEOUS DIFFERENCE EQUATIONS IN THE NEIGHBORHOOD OF AN IRREGULAR SINGULAR POINT, by William J. A. Culmer. Technical rept. no. 6, 16 June-15 Sep 59, on Problems in the Theory of Ordinary Differential and Difference Equations, Contract DA 11-022-ORD-2042. 31 Aug 59, 136p. 9 refs. OOR rept. 1469-6-M.
Order from LC mi$6.90, ph$21.30 PB 144 245

This paper deals with the solution of the linear homogeneous difference equation $X(S+1) = S^h A(S)X(S)$, where h is a constant; the independent variable S is complex; and A(S) is a 2X2 square matrix representable as a power series in 1/S, namely $A(S) = A_0 + \frac{A_1}{S} + \frac{A_2}{S^2} \cdots$, $|S| > S_0$, which, as indicated, is convergent in some neighborhood of $S = \infty$. The coefficients A_0, A_1, A_2, $\cdots$ are known constant matrices with complex elements. The unknown X(S) is a 2X2 matrix also.

Institute of Tech., U. of Minn., Minneapolis.
SINGULAR PERTURBATIONS OF TWO POINT BOUNDARY PROBLEMS FOR SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS, by W. A. Harris, Jr. Technical rept. no. 5, 16 Mar-15 June 59, on Problems in the Theory of Ordinary Differential and Difference Equations, Contract DA 11-022-ORD-2042. 15 July 59, 27p. 11 refs. OOR rept. 1469-5-M.
Order from LC mi$2.70, ph$4.80 PB 144 246

Asymptotic solutions of linear systems of ordinary differential equations are employed to discuss the relationship of the solution of a certain "complete" boundary problem.

$$\left\{\begin{array}{l} dx_1/dt = A_{11}(t,\varepsilon)x_1(t,\varepsilon) + \cdots + A_{1\rho}(t,\varepsilon)x_\rho(t,\varepsilon) \\ \varepsilon^{h_2}(dx_2/dt) = A_{21}(t,\varepsilon)x_1(t,\varepsilon) + \cdots + A_{2\rho}(t,\varepsilon)x_\rho(t,\varepsilon) \\ \qquad\vdots \qquad\qquad\vdots \qquad\qquad\vdots \\ \varepsilon^{h_\rho}(dx_\rho/dt) = A_{\rho 1}(t,\varepsilon)x_1(t,\varepsilon) + \cdots + A_{\rho\rho}(t,\varepsilon)x_\rho(t,\varepsilon) \end{array}\right\}$$
$$R(\varepsilon)x(a,\varepsilon) + S(\varepsilon)x(b,\varepsilon) = c(\varepsilon)$$

as $\varepsilon \to 0+$ and the related "degenerate" problem obtained by setting $\varepsilon = 0$. Here the h_i are integers, $0 < h_2 < \cdots < h_\rho$, x_i is a vector of dimension n_i, $A_{ij}(t,\varepsilon)$ are matrices of appropriate orders with asymptotic expansions, x is the vector $\begin{pmatrix} x_1 \\ \vdots \\ x_\rho \end{pmatrix}$, R and S are square matrices of order $\sum_{i=1}^{\rho} n_i$ and $\varepsilon > c$. It is shown that under certain conditions the solution of the "complete" problem as $\varepsilon \to 0+$ approaches a solution of the "degenerate" differential system and satisfies n_1 appropriate "degenerate" boundary conditions.

Johns Hopkins U., Baltimore, Md.
ON SPHERICAL IMAGE MAPS WHOSE JACOBIANS DO NOT CHANGE SIGN, by Philip Hartman and Louis Nirenberg. Technical rept. no. 10 on Contract AF 18(603)41. Mar 59, 30p. 11 refs. AFOSR-TN-59-549; AD-216 659.
Order from LC mi$2.70, ph$4.80 PB 144 340

The first part of the paper deals with mappings p = p(x) of an n-dimensional x region into n-dimensional p space with a Jacobian J(x) which does not change sign. A map p = p(x) is called a gradient map if p(x) is locally a gradient. One of the theorems proved, for example, states that a gradient map p = p(x) with a Jacobian which does not change sign is monotone in the sense that the boundary of the image set is contained in the image of the boundary. Analogous results are valid for the spherical image mapping of an n-dimen-

sional hypersurfaces immersed in (n + 1)-dimensional Euclidean space. The next part of the paper concerns applications of the results of the first part; for example, there are obtained an n-dimensional generalization of the Rado (von Neumann) theorem on saddle surfaces, a characterization of complete hypersurfaces of constant zero curvature in Euclidean spaces as cylinders, and, for n = 2, properties of the x sets grad z(x) = const. if the Hessian determinant of z is identically zero.

Kansas U., Lawrence.
A NOTE ON THE CLOSED HULL OF AN ALMOST PERIODIC FUNCTION: SOME EXAMPLES ASSOCIATED WITH THE REPRESENTATION PROBLEM, by James C. Lillo. Technical rept. no. 2 on Basic Research of Nonlinear Differential Equations, Contract DA 23-072-ORD-1289. Aug 59, 5p.
Order from LC mi$1.80, ph$1.80 PB 144 244

A study of the relationship between the set of Fourier coefficients for an almost periodic function and the set of Fourier coefficients associated with the closed hull of the almost periodic function.

Kansas U., Lawrence.
ON EXPONENTIAL REPRESENTATIONS OF ANALYTIC FUNCTIONS IN THE UPPER HALF-PLANE WITH POSITIVE IMAGINARY PART, by N. Aronszajn and W. F. Donoghue, Jr. Technical rept. 20 on Studies in Eigenvalue Problems, Contract Nonr-583(04). 1957, 76p. 20 refs. AD-145 600.
Order from LC mi$4.50, ph$12.30 PB 137 574

The work presented in this paper has its origin in certain theorems which were needed by the authors for their forthcoming paper on "Finite dimensional perturbations of spectral problems and approximation methods". These theorems were closely related to results obtained by S. Verblunsky and H. Delange but could not be deduced from those results. Thus we were led to investigate in general the question of the exponential representation of functions analytic in the upper half-plane with positive imaginary part there, a class denoted in this paper by P. The results of that investigation form the content of the paper, and the theorems which we required for out future paper as well as the theorems of Verblunsky and Delange occur as very special cases of those results.

Laboratory of Statistical Research, U. of Washington, Seattle.
SOME RELATIONSHIPS INVOLVING SUBORDINATION, by R. M. Blumenthal. Technical rept. no. 30 on Contract Nonr-477(11). 3 Oct 58, 15p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 143 792

Michigan State U. [East Lansing].
MULTIVARIATE CHEBYSHEV TYPE INEQUALITIES, by Albert W. Marshall and Ingram Olkin. Interim technical rept. no. 14 on Contract DA 20-018-ORD-14735. 25 Aug 59, 35p. 9 refs. OOR rept. 1840.12-M.
Order from LC mi$3.00, ph$6.30 PB 144 466

Various inequalities involving the minimum component or the product of components of a random vector are considered. Derivations and proofs of sharpness for these two classes of inequalities show remarkable similarities. Some of each type occur as special cases of a general theorem.

Michigan State U., [East Lansing].
A ONE-SIDED INEQUALITY OF THE CHEBYSHEV TYPE, by Ingram Olkin and Albert W. Marshall. Interim technical rept. no. 13 on Contract DA 20-018-ORD-14735. 25 June 59, 12p. 2 refs. OOR Rept. no. 1840:11.
Order from LC mi$2.40, ph$3.30 PB 144 086

Let $x = (x_1, \ldots, x_k)$ be a random vector with $Ex_i = 0$ and either (i) $Ex_i^2 = \sigma^2$, $Ex_ix_j = \sigma^2\rho$ $(i \neq j)$, $i, j = 1, \ldots, k$, or (ii) $Ex_i^2 = \sigma_i^2$, $i = 1, \ldots, k$. In each case a sharp upper bound (only involving the specified moments) for $P[x_1 \geq 1 \text{ or } \ldots \text{ or } x_k \geq 1]$ is obtained. A formulation for more general one-sided bounds is also discussed.

Michigan State U., East Lansing.
ORTHOGONAL POLYNOMIALS IN ONE AND TWO DIMENSIONS, by Heinrich Larcher and Ingram Olkin. Technical rept. no. 7 on Basic Research in Multivariate Analysis, Contract DA 20-018-ORD-14735. 17 May 57, 17p. 3 refs. AD-131 491.
Order from LC mi$2.40, ph$3.30 PB 137 834

Two methods of obtaining systems of orthogonal polynomials for given 1- and 2-dimensional regions are developed. One technique is the modification of that presented by Grobner (Monatshefte fur Mathematik 52:38-54, 1948) so that the system for certain regions in the x-y plane may be obtained immediately by the calculus of variations. The method concerns itself with regions for which a closed form expression for the polynomial exists. In certain cases the polynomial might be a function of x alone; the procedure may be carried out with x and y interchanged. Examples are worked out which define systems of orthogonal polynomials for the square with corners (1, 1), (-1, 1), (-1, -1), and (1, -1); and for the triangle with vertices (0, 0), (1, 0), and (0. 1). A new method is also developed which permits a generalization to higher dimensions. Two examples are considered, one for a linear interval and a second for a triangular region in the x-y plane. These polynomials are the same as those obtained by Grobner. From this procedure it is evident that by defining polynomials in 2 variables differently, other systems of orthogonal polynomials for a given region which are complete may be obtained.

Minnesota U. School of Business Administration, Minneapolis.
CONTRIBUTIONS TO THE THEORY OF RANK ORDER STATISTICS: THE ONE-SAMPLE CASE, by Richard Savage. Technical rept. no. 3 on Contract Nonr-2582(00). 25 Jan 59, 10p. 4 refs.
Order from LC mi$1.80, ph$1.80 PB 144 399

The one-sample problem is considered using techniques developed earlier. Let $Z=(Z_1,\ldots,Z_N)$ be a random vector with $Z_i=1(0)$ if the i-th smallest in absolute value in a sample of N from the density f(x) is positive (negative). Then

$$P(Z=z)=N!\int\ldots\int\prod_{i=1}^{N}[f^{1-z_i}(-y_i)f^{z_i}(y_i)dy_i]$$

$$0\le y_1\le\ldots\le y_N\le\infty$$

Conditions are found implying $P(Z=z)>P(Z=z')$ where z is derived from z' by replacing a 0 by a 1, or interchanging a 0 and 1 in z' by moving the 1 to the right. These conditions are met by the normal and other distributions.

Missouri U., Columbia.
ON A THEOREM OF E. SPARRE ANDERSEN AND ITS APPLICATION TO TESTS AGAINST TREND, by H. D. Brunk. Technical rept. no. 13 on Contract AF 18(600)1108. Aug 59, 46p. 11 refs. AFOSR-TN-59-856.
Order from LC mi$3.30, ph$7.80 PB 144 309

Missouri U., Columbia.
UNSTABLE HOMEOMORPHISMS AND THE CLOSED 2-CELL, by J. F. Jakobsen and W. R. Utz. Technical rept. no. 12 on Contract AF 18(600)1108. Aug 59, 15p. 7 refs. AFOSR-TN-59-855.
Order from LC mi$2.40, ph$3.30 PB 144 308

Naval Ordnance Test Station, China Lake, Calif.
SOLVING DIFFERENTIAL EQUATIONS BY FOURIER SERIES, by H. J. Fletcher and C. J. Thorne. 17 Sep 59, 38p. 7 refs. NOTS TP-2322; NAVORD rept. 6590.
Order from LC mi$3.00, ph$6.30 PB 144 201

A promising method of solving linear and nonlinear problems is investigated and many properties of use in obtaining such solutions are developed. This worl was performed during 1957. It was supported by Bureau of Ordnance Task Assignment 520-226-61006/02054, Local Project 278, and Technical Overhead, a distributable general overhead expense. Properties of Fourier series useful in obtaining solutions of linear and nonlinear differential equations are investigated.

Northwestern U., Evanston, Ill.
ON THE APPROXIMATION OF INTEGRABLE FUNCTIONS BY FUNCTIONS OF BOUNDED VARIATION, by William T. Reid. Technical rept. no. 4 on Contract AF 49(638)400. Aug 59, 11p. 9 refs. AFOSR-TN-59-825.
Order from LC mi$2.40, ph$3.30 PB 144 375

Northwestern U. [Evanston, Ill.]
PROPERTIES OF SOLUTIONS OF A RICCATI MATRIX DIFFERENTIAL EQUATION, by William T. Reid. Technical rept. no. 3 on Contract AF 49(638)400. Aug 59, 30p. 17 refs. AFOSR-TN-59-826.
Order from LC mi$2.70, ph$4.80 PB 144 497

In the present paper it is shown that the analytic methods of the author's earlier paper yield properties of the type presented by Redheffer; an amended form is given for the final conclusion of Redheffer's Theorem XII, which is in error. In addition, certain results of the present paper are cast in a form to establish the existence of solutions, rather than to postulate their existence as in the earlier treatments of the author and Redheffer. In particular, the improved result corresponding to Theorem 4.1 of the author's earlier paper involves an extension of a quadratic form problem considered a number of years ago by the author and several other writers. Special attention is given to Riccati equations arising as the Legendre equation for a variational problem. Finally, it is shown that the methods of the author provide the main theorem of a recent report by Redheffer on the Mycielski-Paszowski diffusion problem.

Princeton U., N. J.
A GENERAL THEORY OF MEASUREMENT: APPLICATIONS TO UTILITY, by Johann Pfanzagl. Research memo. no. 5 on Econometric Research Program [Contract Nonr-1858(02)] 8 Dec 58, 20p. 18 refs.
Order from LC mi$2.40, ph$3.30 PB 144 290

Purdue Research Foundation, Lafayette, Ind.
ANALYTICAL THEORY OF CONTINUOUS TRANSFORMATIONS, III, by Togo Nishiura. Technical note no. 22 on Contract AF 18(600)1484. Aug 59, 19p. 22 refs. PRF-1203; AFOSR-TN-59-496; AD-215 921.
Order from LC mi$2.40, ph$3.30 PB 144 071

This technical note is the last of a series of three notes. The three notes concern extensions of the area theory developed by L. Casari in his book Surface Area, Princeton University Press, 1956. The first two notes ("Analytic Theory of Continuous Transformations I, II") concerned the analog of the Geöcze area for continuous mappings from certain subsets of Euclidean k-space E_k into Euclidean n-space E_n, $n\ge k\ge 2$. The present note deals with the generalized length of a contour and the Cavalieri inequality for continuous mappings defined on admissible sets in the plane. (See also PB 143 179)

Purdue U., Lafayette, Ind.
ANALYTIC THEORY OF CONTINUOUS TRANSFORMATIONS I, by Togo Nishiura. Technical note no. 20 on Contract AF 18(600)1484. Aug 59, 67p. 22 refs. PRF 1203; AFOSR-TN-59-496; AD-215 921.
Order from LC mi$3.90, ph$10.80 PB 143 179

This technical note is the first of a series of three notes. The three notes concern extensions of the area theory developed by L. Cesari in his book Surface Area, Princeton University Press, 1956. The first two notes concern the analog of the Geöcze area for continuous mappings from certain subsets of Euclidean k-space E_k into Euclidean n-space E_n, $n\ge k\ge 2$.

Purdue U., Lafayette, Ind.
ANALYTIC THEORY OF CONTINUOUS TRANSFORMATIONS II, by Togo Nishiura. Technical note no. 21 on Contract AF 18(600)1484. Aug 59, 67p. 22 refs.

PRF-1203; AFOSR-TN-59-496a; AD-215 921.
Order from LC mi$3.90, ph$10.80 PB 143 180

The present note is a continuation of the extension of the theory of the Geőcze "k-area" which was started in the first note. (See also PB 143 179)

Purdue U., Lafayette, Ind.
RETRACTION ONTO DENDRITES, by A. Lauria and C. J. Neugebauer. Technical note no. 18 on Analytical Theory of Continuous Transformations, Contract AF 18(600)1484. Nov 59, 14p. 6 refs. PRF 1203; AFOSR-TN-59-802.
Order from LC mi$2.40, ph$3.30 PB 144 214

Rensselaer Polytechnic Inst., Troy, N. Y.
A COMPUTATIONAL PROOF PROCEDURE; AXIOMS FOR NUMBER THEORY; RESEARCH ON HILBERT'S TENTH PROBLEM, by Martin Davis and Hilary Putnam (Princeton U.). Rept. on Contract AF 49(638)527. Oct 59, 80p. 9 refs. AFOSR-TR-59-124.
Order from LC mi$4.50, ph$12.30 PB 144 296

Wayne State U., Detroit, Mich.
GROUPS OF AUTOMORPHISMS OF KAEHLER MANIFOLDS, by S. I. Goldberg. Rept. on Contract AF 49(638)14. July 59, 8p. 4 refs. AFOSR-TN-59-727.
Order from LC mi$1.80, ph$1.80 PB 143 953

Lichnerowicz proved that the largest connected Lie group of conformal transformations of a compact Einstein-Kaehler space $M^{2k}(k>1)$ leaves invariant the Kaehlerian structure. In this note the following much stronger result is obtained: The largest connected Lie group of conformal transformations of a 4k - dimensional compact Kaehler manifold coincides with the largest connected group of automorphisms. Theorems of a less general nature but with no restriction on the dimension of the manifold are also obtained. These results can be partially extended to the open Kaehlerian manifolds and hold also for those symplectic manifolds in which the fundamental exterior 2- form is harmonic.

Computing Devices

Air Force Cambridge Research Center, Bedford, Mass.
THE USE OF COSET EQUIVALENCE IN THE ANALYSIS AND DECODING OF GROUP CODES, by Eugene Prange. June 59, 32p. 12 refs. AFCRC-TR-59-164.
Order from LC mi$3.00, ph$6.30 PB 143 967

For an error-correcting code group A, the group G of coordinate permutations that map A onto itself is used to define an equivalence relation on A-cosets. It is shown that this equivalence relation can be used in the analysis of the error-correcting properties of A, and in the definition and verification of operationally feasible decoding algorithms that satisfy the minimal distance criterion. Decoding algorithms under a (weak) block length criterion are also considered for a special class of group codes. Applications are made to some specific codes, the largest being a code in two symbols whose words have 45 information and 28 check positions.

Avion Div., ACF Industries, Inc., Alexandria, Va.
TWELVE DIGIT BINARY ENCODER, by R. W. Smith. Final rept. on Research and Development of an Experimental Model Binary Encoder, Contract DA 36-039-sc-72814. 15 Aug 57, 50p. AD-144 403.
Order from LC mi$3.30, ph$7.80 PB 138 092

An analysis is presented of the work done on developing and constructing a 12-digit binary encoder which converts dc analog voltages to corresponding binary numbers. The device produces binary digital numbers consisting of 11 bits and a sign bit at the rate of 500 complete codes per second. The encoding rate is determined by the frequency of an external start pulse and can vary from zero to the maximum of 500 codes per second. The analog input range is -50 v to +50 v, while the binary parallel output range extends from all zeros at -50 v to all ones at 50 v. The 5 phases of the project are discussed; they include system study and design, circuit design and test, prototype construction and test, final model construction and test, and the instruction manual and final report. The problems encountered are pointed out and their solutions are given. Photographs of the final model are included with drawings and specifications. The conclusions indicate that the unit can be reproduced easily and economically. The feasibility of transistorizing the encoder is discussed.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
EDVAC SYNCHRONOUS MAGNETIC DRUM, by Chester H. Wallin and John G. Gregory. Apr 56, 24p. 5 refs. Memo. rept. no. 1001.
Order from LC mi$2.70, ph$4.80 PB 144 085

The electrical, logical, operational and servicing features of the EDVAC Synchronous Magnetic Drum Storage System are described in this report. The technique used to synchronize drum rotation with the EDVAC system, the method of transferring information to and from the drum, and the necessary controls for controlling the flow of information are completely described. Schematic, logical and mechanical drawings are included.

Columbia U. School of Engineering, New York
A DIGITAL ANALOG CONTROLLER FOR SAMPLED DATA SYSTEMS, by Stephen C. Bigelow. Technical rept. no. T-36/B on Contract AF 18(600)677 22 July 59, 55p. 6 refs. CU-56-59-AF-677-EE; AFOSR-TN-59-803.
Order from LC mi$3.60, ph$9.30 PB 143 961

This report describes a practical digital controller for sampled data control systems designed and constructed by the author under this contract. The controller is a hybrid digital-analog computer programmed to solve the control equations. The machine input and output signals are voltage analogs in the

range of from -50 to +50 volts. Arithmetic operations are performed using analog computer circuits, while storage is accomplished in digital storage registers. Analog-to-digital and digital-to-analog conversions are performed internally. It is believed that this controller serves a twofold purpose: First to demonstrate the feasibility of applying the well-developed theory of sampled data control systems to real processes, and second to provide a useful tool for further study of such systems.

General Kinetics, Inc., Arlington, Va.
OPTIMUM CODING 1103A COMPUTER, by A. C. Hendrikson, J. G. Mackinney, and A. E. Roberts, Jr. Final technical rept. on Contract DA 36-034-ORD-2519. 7 Jan 59, 60p. AD-210 180.
Order from LC mi$3.60, ph$9.30 PB 144 243

This report presents detailed results of a study performed to develop an "optimum" coding for the ERA 1103A type high-speed electronic computer. This coding is constructed to obtain characteristic values and vectors of symmetrical 2x2, 3x3, and 4x4 matrices (formed from coefficients of normal equations derived by least squares methods). The coding is general and intended to separate two, three, or four nearly identical characteristic values. Provision is included for print-out of direction cosines, magnitude, square root of magnitude and its reciprocal; checks are made for orthogonality of vectors to six significant figures and agreement to ± 10 units upon substitution in the original normal equations. Options for conversion of direction cosines to direction angles or to azimuth and elevation angles for print-out are supplied. The studies upon which coding was based included analysis of the many mathematical methods available and selection of those most appropriate for the required purpose. It is contemplated that a complete listing of the program code, together with operating instructions, will be included in a later Supplementary Report covering operational verification of the coding, which was not obtained during the subject contract period.

Northeastern U., Boston, Mass.
AN EXAMPLE AND EXTENSION OF CAPACITY CALCULATION OF A CERTAIN DISCRETE CHANNEL WITH MEMORY, by Sze-Hou Chang and Paul G. McHugh. Scientific rept. no. 2 on Contract AF 19(604)3053. 31 Aug 59, 21p. 2 refs. AFCRC-TN-59-569.
Order from LC mi$2.70, ph$4.80 PB 144 419

In a previous report the capacity of a certain binary channel with finite memory is studied. To illustrate the method of capacity calculation a channel is devised which possesses two types of imperfections, (1) the distortion due to memory and (2) contamination due to noise. This example demonstrates the relative effects of noise and memory, the increase of capacity by tolerating a greater interdigital interference and the use of pulse weighting to counteract the effect of memory. The method of calculation is further extended from the binary channel to the m-nary channel.

Rome Air Development Center, Griffiss AFB, N. Y.
IBM MILITARY COMPUTER SYSTEM, by Frank S. Morreale. Oct 59, 19p. 2 refs. RADC-TN-59-283.
Order from LC mi$2.40, ph$3.30 PB 144 467

The general design characteristics of a computer system developed by International Business Machines, Inc., is described. The system was developed to meet the data processing requirements of Semi-automatic Ground Environment (SAGE) and the Strategic Air Command Control (SACCS) Systems. The term "IBM Military Computer" is an IBM nomenclature. Air Force nomenclature for the SAGE version is AN/FSQ7-A. SACCS version has no Air Force nomenclature. Brief functional descriptions of the major computer elements are given. Typical peripheral equipments that make up the complete data processing system are also given a brief resumé.

MECHANICS

Brown U. Div. of Engineering, Providence, R. I.
ON THE STABILITY OF RIGID-PLASTIC SOLIDS, by G. R. Cowper and E. T. Onat. Technical rept. no. 10 on Contract Nonr-562(20). Dec 58, 10p. 5 refs. Nonr-562(20)/10.
Order from LC mi$1.80, ph$1.80 PB 143 982

An alternative derivation of the stability of a rigid strain-hardening body under dead loading bases on a rational perturbation procedure.

Brown U. Div. of Engineering, Providence, R. I.
PREDICTION OF ELASTIC CONSTANTS OF MULTI-PHASE MATERIALS, by B. Paul. Technical rept. no. 3 on Contract Nonr-562(19). Jan 59, 17p. 5 refs. Nonr-562(19)/3.
Order from LC mi$2.40, ph$3.30 PB 144 146

The energy theorems of elasticity theory are used to find upper and lower bounds on the elastic moduli in tension and shear for two-phase materials. A "strength of materials" type of approximate solution is also given. Comparison with experimental data for a particular alloy system shows good correlation for the approximate solution, with the scatter band bounded by the predicted limits. It is shown that the method may also be used for more general multiphase systems, and to predict temperature dependence of the elastic constants of the composite material.

Brown U. Div. of Engineering, Providence, R. I.
AN EXPERIMENTAL INVESTIGATION OF THE INTERNAL FRICTION OF THIN PLATINUM ALLOY WIRES AT LOW FREQUENCIES, by J. Kestin and J. M. Moszynski. Technical rept. 11 on Contract AF 18(600)891. July 58, 32p. 7 refs. AF-891/11; AFOSR-TN-58-752; AD-201 516.
Order from LC mi$3.00, ph$6.30 PB 137 431

Measurement of viscosity of gases and vapours by the method of small oscillations requires the knowledge of the internal friction of the suspension wire, and of its variation with temperature. An instrument was

built for the measurement of internal friction of thin wires at low frequencies and at elevated temperatures. Wire made of No. 479 Platinum Alloy (8% Tungsten, 92% Pt), stress relieved and in sizes of 0.002" diameter or over are most suitable and their damping characteristics and elastic constants at any temperature in the range up to 400 C can be predicted quite accurately.

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
STRESSES IN THE PLASTIC RANGE AROUND A NORMALLY LOADED CIRCULAR HOLE ON AN INFINITE SHEET, by O. L. Mangasarian. Technical rept. no. 4 on Contract Nonr-1866(02). Dec 58, 38p. 16 refs.
Order from LC mi$3.00, ph$6.30 PB 143 987

The stresses in the plastic range around a normally loaded circular hole in an infinite sheet are found numerically on the basis of both J_2 deformation and incremental theories. The results of deformation theory are quantitatively assessed in the light of a criterion, recently developed by Budiansky, for the acceptability of deformation theories. The criterion is completely satisfied. Moreover, the results obtained by using these two different theories of plasticity do not differ greatly despite the fact that the stress paths are far from being radial.

Illinois Inst. of Tech., Chicago.
YIELD CONDITIONS FOR ROTATIONALLY SYMMETRIC SHELLS, by Philip G. Hodge, Jr. Rept. on Contract Nonr-1406(04). Dec 58, 34p. 12 refs. DOMIIT Rept. no. 1-4.
Order from LC mi$3.00, ph$6.30 PB 143 985

The yield condition for a rotationally symmetric shell may be represented as a surface in a four dimensional stress space. The exact yield surface according to the Tresca yield condition is compared with various approximations. A new approximation is suggested which combines the advantages of mathematical simplicity and reasonable accuracy. The theory is illustrated with reference to a spherical cap under uniform pressure.

Illinois Inst. of Tech., Urbana.
THE YIELD POINT LOAD OF AN ANNULAR PLATE, by Philip G. Hodge, Jr. Rept. on Contract Nonr-1406(04). Jan 59, 8p. 1 ref. DOMIIT Rep. no. 1-5.
Order from LC mi$1.80, ph$1.80 PB 144 142

The yield point load is computed for an annular plate, simply supported at its inner and outer edges, and subjected to a uniform load. A previously published solution is shown to be incorrect.

Institute of Flight Structures, Columbia U., New York.
DYNAMICAL RESPONSE OF AN ELASTIC HALF-SPACE TO TANGENTIAL SURFACE LOADINGS, by Chi-chang Chao. Technical rept. no. 11 on Contract Nonr-266(20). Mar 58, 62p. 22 refs. CU-11-58-ONR-266(20)CE.
Order from LC mi$3.90, ph$10.80 PB 138 589

Exact and closed-form solutions are obtained for both tangential and vertical surface displacements of a homogeneous isotropic elastic half-space due to the application, at a point on the surface, of a concentrated force tangential to the plane boundary and varying with time as the Heaviside unit function. Similar expressions for the displacements in the interior of the body along a line directly below the applied force are derived. Solutions are obtained by a semi-inverse method with the aid of Laplace and Hankel transforms. Combination of these solutions with those given earlier by Lamb and Pekeris, which give the surface displacements due to the application of a normal time-dependent force, will give the response to any inclined time-dependent force applied on the plane boundary. The reciprocal relation in the static case, between tangential surface displacement due to a vertical force and vertical surface displacement due to a tangential force applied on the plane boundary is preserved in the dynamic case.

Naval Civil Engineering Lab., Port Hueneme, Calif.
ELASTO-PLASTIC RESPONSE OF REINFORCED CONCRETE BEAMS TO SHORT-DURATION LOADS, by S. K. Takahashi. 25 Sep 59, 21p. 5 refs. Technical rept. 035.
Order from LC mi$2.70, ph$4.80 PB 143 964

Response of beams to short-duration loads as predicted by the spring-mass theory agrees well with measurements.

Naval Ordnance Lab., White Oak, Md.
MOMENTS OF INERTIA OF N-GONALLY SYMMETRIC BODIES, by R. S. Sery. 6 Apr 59, 21p. 5 refs. NAVORD rept. 6301.
Order from LC mi$2.70, ph$4.80 PB 144 334

Moment of inertia problems usually involve single objects such as cubes, spheres, cones or more complicated types. Occasionally a problem arises in which a group of identical, symmetrically arranged objects must be considered as an entity in order that its moment of inertia may be determined. The five fins of a hypothetical guided missile, for example, can be considered as a compound body. If the symmetry of this body is such that a rotation of $2\pi n/N$ ($n = 1, 2, 3, 4$) about the axis of symmetry is a covering operation, i.e., the final distribution of matter in the body is identical to the initial distribution, then the compound body is N-gonally symmetric. In this report three N-gonal moment of inertia equations are derived. The first of the two equations gives the moments of inertia of the body about the two principal axes which are transverse to the axis of symmetry. The second equation gives the moment of inertia of the body about the third principal axis (the axis of symmetry).

Naval Research Lab., U. of Wisconsin, Madison.
EQUATION OF STATE FOR BINARY FLUID MIXTURES, by Charles E. Hecht. Rept. on Contract N7onr-285(11). 9 Aug 57, 20p. 16 refs. WIS-ONR-24; AD-143 280.
Order from LC mi$2.40, ph$3.30 PB 137 695

range of from -50 to +50 volts. Arithmetic operations are performed using analog computer circuits, while storage is accomplished in digital storage registers. Analog-to-digital and digital-to-analog conversions are performed internally. It is believed that this controller serves a twofold purpose: First to demonstrate the feasibility of applying the well-developed theory of sampled data control systems to real processes, and second to provide a useful tool for further study of such systems.

General Kinetics, Inc., Arlington, Va.
OPTIMUM CODING 1103A COMPUTER, by A. C. Hendrikson, J. G. Mackinney, and A. E. Roberts, Jr. Final technical rept. on Contract DA 36-034-ORD-2519. 7 Jan 59, 60p. AD-210 180.
Order from LC mi$3.60, ph$9.30 PB 144 243

This report presents detailed results of a study performed to develop an "optimum" coding for the ERA 1103A type high-speed electronic computer. This coding is constructed to obtain characteristic values and vectors of symmetrical 2x2, 3x3, and 4x4 matrices (formed from coefficients of normal equations derived by least squares methods). The coding is general and intended to separate two, three, or four nearly identical characteristic values. Provision is included for print-out of direction cosines, magnitude, square root of magnitude and its reciprocal; checks are made for orthogonality of vectors to six significant figures and agreement to ± 10 units upon substitution in the original normal equations. Options for conversion of direction cosines to direction angles or to azimuth and elevation angles for print-out are supplied. The studies upon which coding was based included analysis of the many mathematical methods available and selection of those most appropriate for the required purpose. It is contemplated that a complete listing of the program code, together with operating instructions, will be included in a later Supplementary Report covering operational verification of the coding, which was not obtained during the subject contract period.

Northeastern U., Boston, Mass.
AN EXAMPLE AND EXTENSION OF CAPACITY CALCULATION OF A CERTAIN DISCRETE CHANNEL WITH MEMORY, by Sze-Hou Chang and Paul G. McHugh. Scientific rept. no. 2 on Contract AF 19(604)3053. 31 Aug 59, 21p. 2 refs. AFCRC-TN-59-569.
Order from LC mi$2.70, ph$4.80 PB 144 419

In a previous report the capacity of a certain binary channel with finite memory is studied. To illustrate the method of capacity calculation a channel is devised which possesses two types of imperfections, (1) the distortion due to memory and (2) contamination due to noise. This example demonstrates the relative effects of noise and memory, the increase of capacity by tolerating a greater interdigital interference and the use of pulse weighting to counteract the effect of memory. The method of calculation is further extended from the binary channel to the m-nary channel.

Rome Air Development Center, Griffiss AFB, N. Y.
IBM MILITARY COMPUTER SYSTEM, by Frank S. Morreale. Oct 59, 19p. 2 refs. RADC-TN-59-283.
Order from LC mi$2.40, ph$3.30 PB 144 467

The general design characteristics of a computer system developed by International Business Machines, Inc., is described. The system was developed to meet the data processing requirements of Semi-automatic Ground Environment (SAGE) and the Strategic Air Command Control (SACCS) Systems. The term "IBM Military Computer" is an IBM nomenclature. Air Force nomenclature for the SAGE version is AN/FSQ7-A. SACCS version has no Air Force nomenclature. Brief functional descriptions of the major computer elements are given. Typical peripheral equipments that make up the complete data processing system are also given a brief resumé.

MECHANICS

Brown U. Div. of Engineering, Providence, R. I.
ON THE STABILITY OF RIGID-PLASTIC SOLIDS, by G. R. Cowper and E. T. Onat. Technical rept. no. 10 on Contract Nonr-562(20). Dec 58, 10p. 5 refs. Nonr-562(20)/10.
Order from LC mi$1.80, ph$1.80 PB 143 982

An alternative derivation of the stability of a rigid strain-hardening body under dead loading bases on a rational perturbation procedure.

Brown U. Div. of Engineering, Providence, R. I.
PREDICTION OF ELASTIC CONSTANTS OF MULTI-PHASE MATERIALS, by B. Paul. Technical rept. no. 3 on Contract Nonr-562(19). Jan 59, 17p. 5 refs. Nonr-562(19)/3.
Order from LC mi$2.40, ph$3.30 PB 144 146

The energy theorems of elasticity theory are used to find upper and lower bounds on the elastic moduli in tension and shear for two-phase materials. A "strength of materials" type of approximate solution is also given. Comparison with experimental data for a particular alloy system shows good correlation for the approximate solution, with the scatter band bounded by the predicted limits. It is shown that the method may also be used for more general multi-phase systems, and to predict temperature dependence of the elastic constants of the composite material.

Brown U. Div. of Engineering, Providence, R. I.
AN EXPERIMENTAL INVESTIGATION OF THE INTERNAL FRICTION OF THIN PLATINUM ALLOY WIRES AT LOW FREQUENCIES, by J. Kestin and J. M. Moszynski. Technical rept. 11 on Contract AF 18(600)891. July 58, 32p. 7 refs. AF-891/11; AFOSR-TN-58-752; AD-201 516.
Order from LC mi$3.00, ph$6.30 PB 137 431

Measurement of viscosity of gases and vapours by the method of small oscillations requires the knowledge of the internal friction of the suspension wire, and of its variation with temperature. An instrument was

built for the measurement of internal friction of thin wires at low frequencies and at elevated temperatures. Wire made of No. 479 Platinum Alloy (8% Tungsten, 92% Pt), stress relieved and in sizes of 0.002" diameter or over are most suitable and their damping characteristics and elastic constants at any temperature in the range up to 400 C can be predicted quite accurately.

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
STRESSES IN THE PLASTIC RANGE AROUND A NORMALLY LOADED CIRCULAR HOLE ON AN INFINITE SHEET, by O. L. Mangasarian. Technical rept. no. 4 on Contract Nonr-1866(02). Dec 58, 38p. 16 refs.
Order from LC mi$3.00, ph$6.30 PB 143 987

The stresses in the plastic range around a normally loaded circular hole in an infinite sheet are found numerically on the basis of both J_2 deformation and incremental theories. The results of deformation theory are quantitatively assessed in the light of a criterion, recently developed by Budiansky, for the acceptability of deformation theories. The criterion is completely satisfied. Moreover, the results obtained by using these two different theories of plasticity do not differ greatly despite the fact that the stress paths are far from being radial.

Illinois Inst. of Tech., Chicago.
YIELD CONDITIONS FOR ROTATIONALLY SYMMETRIC SHELLS, by Philip G. Hodge, Jr. Rept. on Contract Nonr-1406(04). Dec 58, 34p. 12 refs. DOMIIT Rept. no. 1-4.
Order from LC mi$3.00, ph$6.30 PB 143 985

The yield condition for a rotationally symmetric shell may be represented as a surface in a four dimensional stress space. The exact yield surface according to the Tresca yield condition is compared with various approximations. A new approximation is suggested which combines the advantages of mathematical simplicity and reasonable accuracy. The theory is illustrated with reference to a spherical cap under uniform pressure.

Illinois Inst. of Tech., Urbana.
THE YIELD POINT LOAD OF AN ANNULAR PLATE, by Philip G. Hodge, Jr. Rept. on Contract Nonr-1406(04). Jan 59, 8p. 1 ref. DOMIIT Rep. no. 1-5.
Order from LC mi$1.80, ph$1.80 PB 144 142

The yield point load is computed for an annular plate, simply supported at its inner and outer edges, and subjected to a uniform load. A previously published solution is shown to be incorrect.

Institute of Flight Structures, Columbia U., New York.
DYNAMICAL RESPONSE OF AN ELASTIC HALF-SPACE TO TANGENTIAL SURFACE LOADINGS, by Chi-chang Chao. Technical rept. no. 11 on Contract Nonr-266(20). Mar 58, 62p. 22 refs. CU-11-58-ONR-266(20)CE.
Order from LC mi$3.90, ph$10.80 PB 138 589

Exact and closed-form solutions are obtained for both tangential and vertical surface displacements of a homogeneous isotropic elastic half-space due to the application, at a point on the surface, of a concentrated force tangential to the plane boundary and varying with time as the Heaviside unit function. Similar expressions for the displacements in the interior of the body along a line directly below the applied force are derived. Solutions are obtained by a semi-inverse method with the aid of Laplace and Hankel transforms. Combination of these solutions with those given earlier by Lamb and Pekeris, which give the surface displacements due to the application of a normal time-dependent force, will give the response to any inclined time-dependent force applied on the plane boundary. The reciprocal relation in the static case, between tangential surface displacement due to a vertical force and vertical surface displacement due to a tangential force applied on the plane boundary is preserved in the dynamic case.

Naval Civil Engineering Lab., Port Hueneme, Calif.
ELASTO-PLASTIC RESPONSE OF REINFORCED CONCRETE BEAMS TO SHORT-DURATION LOADS, by S. K. Takahashi. 25 Sep 59, 21p. 5 refs. Technical rept. 035.
Order from LC mi$2.70, ph$4.80 PB 143 964

Response of beams to short-duration loads as predicted by the spring-mass theory agrees well with measurements.

Naval Ordnance Lab., White Oak, Md.
MOMENTS OF INERTIA OF N-GONALLY SYMMETRIC BODIES, by R. S. Sery. 6 Apr 59, 21p. 5 refs. NAVORD rept. 6301.
Order from LC mi$2.70, ph$4.80 PB 144 334

Moment of inertia problems usually involve single objects such as cubes, spheres, cones or more complicated types. Occasionally a problem arises in which a group of identical, symmetrically arranged objects must be considered as an entity in order that its moment of inertia may be determined. The five fins of a hypothetical guided missile, for example, can be considered as a compound body. If the symmetry of this body is such that a rotation of $2\pi n/N$ ($n = 1, 2, 3, 4$) about the axis of symmetry is a covering operation, i.e., the final distribution of matter in the body is identical to the initial distribution, then the compound body is N-gonally symmetric. In this report three N-gonal moment of inertia equations are derived. The first of the two equations gives the moments of inertia of the body about the two principal axes which are transverse to the axis of symmetry. The second equation gives the moment of inertia of the body about the third principal axis (the axis of symmetry).

Naval Research Lab., U. of Wisconsin, Madison.
EQUATION OF STATE FOR BINARY FLUID MIXTURES, by Charles E. Hecht. Rept. on Contract N7onr-285(11). 9 Aug 57, 20p. 16 refs. WIS-ONR-24; AD-143 280.
Order from LC mi$2.40, ph$3.30 PB 137 695

A perturbation technique already used for the equation of state of pure substances by Zwanzig is developed to deal with binary fluid mixtures. We use a modified Lennard-Jones potential of pseudo-one component form for the unperturbed ensemble and introduce some effects of the specific potentials of the species involved as the perturbation. The most useful part of this report may be the zeroeth order results which give compressibility factors for gaseous mixtures fairly well at high temperatures.

Technische Hochschule, Hannover (West Germany).
DYNAMICS OF STRUCTURES BY TRANSFER MATRICES, by E. Pestel. Technical rept. no. 1 on Contract AF 61(052)33. June 59, 185p. 36 refs. AFOSR-TR-59-95.
Order from LC mi$8.40, ph$28.80 PB 144 294

Contents:
Eigenvalues and the transfer matrix
Calculation of rotating disks using transfer matrices.
Catalogue of transfer matrices
Coupling of beams
Delta-matrices and other modifications of the use of transfer matrices
Modified transfer matrix method
Structural analysis of aircraft components by transfer matrices
Application of transfer matrices to plates
Bibliography

Technische Hochschule, Hannover (West Germany).
THIN-WALLED COMPRESSION MEMBERS, by A. Pflüger. Rept. no. 2 (Final) on Contract AF 61(514)1140. July 59, 15p. 10 refs. AFOSR-TR-59-138.
Order from LC mi$2.40, ph$3.30 PB 144 313

This report treats the magnitude of the deformations occurring as a result of the buckling process. As a consequence of inaccuracies of shape and of the application of load, deformations will occur even before the buckling limit is reached. However, the statistical evaluation of the measurements taken shows these deformations not to exceed the limits permissible within the scope of reasonable demands regarding the outer appearance of a construction. When exceeding the critical value, however, the deformations will increase rapidly. Consequently, the necessary safety factor has to be related to the buckling limit. (See also PB 140 693)

Yale U., New Haven, Conn.
ROTATION TESTS IN PLASTICITY, PART II, by Aris Phillips. Technical rept. no. 6 on Contract Nonr-609(12). Dec 58, 23p. 3 refs.
Order from LC mi$2.70, ph$4.80 PB 143 981

This report is a continuation of technical report No. 3 which appeared in December 1957. In the present report the ten rotation tests K-1 to K-10, which have been presented previously, are submitted to an additional evaluation. The reader is reminded here that in a rotation test the state of stress is changed by keeping the principal stresses constant while the principal directions are rotated. The ten rotation tests which are considered here were made on thin-walled tubes of aluminum alloy 3S-O. In these tests plane states of stress σ_1, σ_2 ($\sigma_1 > \sigma_2$), existing on the outside surface of a thin-walled tube, were rotated to various angles (up to 90°) about the radical direction (the direction of σ_3). The rotation of the principal axes of stress was achieved by using a combination of axial load, internal pressure, and torque.

Aerodynamics and Pneumatics

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
VIBRATION AND FLUTTER OF CYLINDRICAL AND CONICAL SHELLS, by Yechiel Shulman. Rept. on Contract AF 49(638)219. June 59, 181p. 55 refs. ASRL technical rept. no. 74-2; AFOSR-[TN]-59-776.
Order from LC mi$8.40, ph$28.80 PB 144 307

The theory of thin shells is examined and some simplified general expressions are presented. These reduce to Donnell's expressions in the case of circular cylindrical shells. An appropriate variational principle is formulated and the similarity to shallow-shell theory is shown. These results and those of the more exact Flügge shell theory are applied to the problem of free vibration of conical shells. Approximate solutions are obtained by variational methods using the various theories and various displacement and stress functions. Comparison of the results indicates that the method which utilizes a logarithmic transformation of the axial coordinate in conjunction with appropriate displacement expansion modes satisfying the geometrical boundary conditions yields results valid for both the membrane and bending cases and is capable of being used to obtain higher approximations. The results reveal that the influence of taper on membrane and bending frequencies of circular cylinders is opposite in nature, the former being increased, the latter decreased by the taper.

Aeronautical Research Inst. of Sweden.
A THEORETICAL INVESTIGATION OF SECOND-ORDER SUPERSONIC INTERFERENCE EFFECTS, by Beverly J. Beane and Marten T. Landahl. Technical note no. 1 on Contract AF 61(052)75. Apr 59, 18p. 7 refs. FFA rept. AU-II-93:1; AFOSR-TN-59-962.
Order from LC mi$2.40, ph$3.30 PB 144 305

An approximate solution, valid for high Mach numbers, for the second-order supersonic flow problem of two interfering flow fields is given. The approximate solution requires that the spanwise curvature of the body flow field is small. A further approximation is made which leads to a very simple formula for the interference pressure. This formula is found to give relatively small errors in the cases investigated. It is found that second-order interference effects may be large at Mach numbers above 3. Thus it is demonstrated that large gains in control surface efficiency may be obtained by placing the control surface in a region of high pressure from the body.

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
RECENT ADVANCES IN CHEMICAL KINETICS OF HOMOGENEOUS REACTION IN DISSOCIATED AIR, by W. G. Zinman. Rept. on Contract AF 04(647)269. 21 Sep 59, 20p. 41 refs. Technical information series R59SD426.
Order from LC mi$2.40, ph$3.30 PB 143 900

It is shown that the kinetics of certain types of homogeneous gas phase reactions should be considered in many flow problems involving diatomic gases at moderate temperatures. There are two general types of reactions: atom recombination ($A + A + M \rightarrow A_2 + M$) and two body reactions (i.e. $N + O_2 \rightarrow NO + O$). For many atom recombination reactions of technical importance, k_r is about 10^{11} ft.^{6}/lb.-mol.^{2}sec. In general, two body reactions are so rapid compared with atom recombination that certain equilibrium relations will be obeyed in many gas mixtures not in complete thermodynamic equilibrium. The rate constants necessary to determine when this can be done are given.

Air Force Missile Development Center, Holloman AFB, N. Mex.
THE SELECTION OF ORGANIC COMPOUNDS AS ABLATING MATERIALS, by Albert H. Blatt. Oct 59, 9p. 1 ref. AFMDC-TN-59-28.
Order from LC mi$1.80, ph$1.80 PB 144 397

The use of organic compounds as ablating materials for the outer surface of the nose cones of re-entering ballistic missiles and satellites is examined. The paper is concerned with the chemist's point of view; that is, the cracking and dissociation processes. The paper concludes with suggestions about the choice of organic ablating materials.

Air Force Missile Test Center, Patrick AFB, Fla.
THE EDITING OF FLIGHT DATA, by Masao Yoshitsu. Rept. on Missile Test Project, Contract AF 08(606)1156. 3 Aug 59, 76p. 11 refs. RCA DATA Processing Technical rept. no. 50; AFMTC-TR-59-16.
Order from LC mi$4.50, ph$12.30 PB 143 991

Any method of the numerical determination of observations is more or less liable to error. This is expected, provided the errors are small enough to have the data appear credible. On the other hand, the large errors are undesirable as they are outside the scope of the probability theory. An editing technique to eliminate the large errors from flight data, leaving the good statistical data, is developed in this paper. Three examples are worked out to show that even a cluster of five large errors in consecutive observations may be systematically eliminated in the 58 steps of the technique. It is seen that the entire procedure may be readily programmed for a high speed electronic computer.

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
COMPRESSIBLE FLOW TABLES k = 1.26 ISENTROPIC PROCESS, by C. Hoebich. Rept. on One-Dimensional Compressible Flow Tables for a Perfect Gas in Mach Number Increments of 0.001 (k = 1.26); Isentropic Process. Jan 59, 89p. ARGMA TN 1H 1N-1.
Order from LC mi$4.80, ph$13.80 PB 144 413

This report tabulates functions of Mach numbers for compressible perfect gas. The ratio of specific heats k is 1.26. The increment used in these tables is sufficiently small (0.001 Mach number) to eliminate time-consuming interpolation.

Arnold Engineering Development Center [Tullahoma, Tenn.]
REDUCTION OF AIRSTREAM-INDUCED VIBRATIONS OF A PWT MODEL SUPPORT SYSTEM BY TUNNEL MODIFICATIONS, by H. L. Chevalier and W. E. Carleton. Rept. on ARO, Inc., Contract AF 40(600)800. Oct 59, 15p. 2 refs. AEDC-TN-59-125.
Order from LC mi$2.40, ph$3.30 PB 144 339

The effect of several modifications to the tunnel, designed to improve the vibrational characteristics of the support strut, was investigated in the 16-Ft Transonic Circuit of the Propulsion Wind Tunnel Facility. The modifications included changing the shape of the leading edge of the model support strut, the depth and position of bulges in the test section walls, and the position of the scavenging scoop for engine exhaust gases. The results show that the modifications permit the operation of the tunnel over a range of test conditions with safe sting vibrational amplitudes and with a suitable Mach number distribution through the tunnel test section.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
A THEORY OF WING-PROPULSION COMBINATIONS IN SLOW FLIGHT, by R. J. Vidal. Rept. on Proj. 9-38-01-000 Task 902, Contract DA 44-177-tc-439. Sep 59, 39p. 9 refs. Rept. no. AI-1190-A-1; AD-216 171.
Order from LC mi$3.00, ph$6.30 PB 144 241

The development of a theory treating wing-propulsion systems in slow flight is presented. This development is applied to a class of configurations, characterized by wing and propulsion wakes which are equal in span, and is used to predict the performance of this class of aircraft. It is concluded that for aircraft of equal span, those generating thick propulsion wakes require the least power, and that configurations typified by thin jet wakes are inherently inefficient as regards power consumption in the very slow speed range. The theory is compared with the available helicopter data, and good correlation is obtained.

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
AN EXPERIMENTAL INVESTIGATION OF HYPERSONIC STAGNATION TEMPERATURE PROBES, by Richard D. Wood. Rept. on Hypersonic Research Project, Contract DA 04-495-ORD-19. 15 July 59, 100p. 40 refs. Memo. no. 50.
Order from LC mi$5.40, ph$15.30 PB 144 167

By the combined use of both shield and base heating, a probe recovery factor of r = 1.0 was obtained over a

range of Reynolds numbers at M_∞=5.75. By using the experimental data and simple heat balance equations, the probe losses, for the conditions investigated, were found to be in the proportion: shield conduction loss - 15; base conduction loss - 3; thermocouple conduction loss - 1; and thermocouple radiation loss - 3/100. The typical decrease in probe recovery factor observed for decreasing Reynolds number appears to be related to a decrease in the base temperature and not to the wire conduction loss as commonly assumed.

Institut de Recherches Scientifiques et Techniques du Centre-Ouest (France).
RESEARCH ON EXPERIMENTAL INVESTIGATION OF VARIABLE CIRCULATION AROUND AN ASPIRATED CYLINDER. Rept. on Contract AF 61(514) 1379. [1959]‖ 42p. Etude IRST-E1/573; AFOSR-TN-59-105.
Order from LC mi$3.30, ph$7.80 PB 144 295

The object of this study is to determine the conditions necessary to obtain maximum lift and lift/drag ratio for a porous cylinder arranged to permit the aspiration of the surface laminar sub-layer. The method used to create a particular circulation consisted in (assuming complete suppression of the laminar layer) shifting the transition point, normally behind the cylinder, through an angle O to the right or left. This was obtained by a deflector fin which caused flow of air away from the aspirating surface. Two variations in procedure were also studied: 1. the fin was replaced by a small arc of surface devoid of aspiration pores thus allowing the flow to separate. 2. aspiration was provided on one side of the cylinder only allowing separation flow on the other side.

Institute for System Research, U. of Chicago, Ill.
AERODYNAMIC STUDIES: THE FORCES ACTING ON AN AIR VEHICLE: A REVIEW OF THE LITERATURE, by M. Z. Krzywoblocki. Rept. on Scientific and Engineering Research Investigations in Flight Dynamics, Contract AF 33(616)5689. Dec 58, 105p. 332 refs. WADC Technical note 56-360, Pt. 9; AD-161 012.
Order from OTS $2.50 PB 151 819

This work is an annotated bibliography of the scientific literature pertaining to methods of calculating the aerodynamic forces acting on an air vehicle in flight. The more interesting papers and reports (from the viewpoint of the aerodynamicist) are discussed briefly, others are listed without comment. (See also PB 151 815)

Midwest Research Inst. [Kansas City, Mo.]
FLUTTER OF CURVED PANELS, by John E. Yates and Edmond F. E. Zeijdel. Rept. on Contract AF 49(638)429. Sep 59, 45p. 6 refs. [AFOSR-TR-59-163]
Order from LC mi$3.30, ph$7.80 PB 144 486

Previous studies on panel flutter treated the panel as initially flat in the equilibrium state. A natural point of inquiry is the effects of panel curvature on panel flutter, and this is the subject of the present report. To investigate flutter of curved panels, the general equations of motion of shallow cylindrical shells are developed. The initial curvature is then taken as circular in the chordwise direction. The special case of infinite aspect ratio is considered and appropriate equations are developed for finite aspect ratio panels. Results are obtained for unit and infinite aspect ratio curved panels with simply supported edges for two Mach numbers (M = 1.5 and 2).

Naples U. (Italy).
LAMINAR MIXING OF STREAMS OF DIFFERENT GASSES, by Luigi G. Napolitano and A. Pozzi. Technical note no. 1 on Contract AF 61(052)160. Apr 59, 75p. 14 refs. Istituto di Aeronautica rept. no. 10; AFOSR-TN-59-977; AD-226 469.
Order from LC mi$4.50, ph$12.30 PB 143 911

Preliminary results of a study of laminar, isobaric mixing of streams of different gases are presented.

Naval Ordnance Lab., White Oak, Md.
THE THEORY OF STABILITY OF COMPRESSIBLE LAMINAR BOUNDARY LAYERS WITH INJECTION OF A FOREIGN GAS, by S. F. Shen. 28 May 57, 34p. 10 refs. Aeroballistic Research rept. 374; NAVORD rept. 4467; AD-158 520.
Order from LC mi$3.00, ph$6.30 PB 144 158

The stability theory of laminar boundary layers with regard to infinitesimal disturbances is extended to the case involving binary gas mixtures, as may occur when a different coolant is injected into the free stream (air) through pores along the surface. The "inviscid" solutions are given. The "viscous" solutions, the asymptotic solutions and the eigen-value problem are discussed. Based upon the "inviscid-criterion", it appears that a lighter coolant would result in a more stable laminar boundary layer than a heavier coolant, at least for subsonic free stream.

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
FREE CONVECTION PAST A VERTICAL FLAT PLATE: SOME NUMERICAL RESULTS, by Judson R. Baron and Morton Finston. Mar 59, 29p. 3 refs. Technical rept. 269.
Order from LC mi$2.70, ph$4.80 PB 144 186

Exact solutions are presented in numerical form for the free convection flow past a vertical plane surface of non-uniform temperature.

New York U. Coll. of Engineering, N. Y.
ATTEMPTS AT DERIVATION OF TRANSITION FROM LAMINAR INTO TURBULENT FLOW ALONG A FLAT PLATE, by H. F. Ludloff, H. B. Keller and others. Progress rept. on Contract AF 18(603)25. June 59, 30p. 7 refs. AFOSR Technical note 59-686.
Order from LC mi$2.70, ph$4.80 PB 144 324

Polytechnic Inst. of Brooklyn, N. Y.
SOME REMARKS ON THE SOLUTION OF A SYSTEM OF EQUATIONS OCCURRING IN LAMINAR MIXING WITH AXIAL PRESSURE GRADIENTS, by Luigi G.

Napolitano. Rept. on Contract AF 18(600)693. Sep 57, 16p. 1 ref. PIBAL rept. no. 393; AFOSR-TN-57-609; AD-136 599.
Order from LC mi$2.40, ph$3.30 PB 137 507

A fifth-order system of equations with 3-point boundary conditions is investigated from the point of view of obtaining solutions by high-speed computing machines. The first method of solution changes the variables and reduces the original equations to integro-differential equations defined over a finite interval of the independent variable. An iteration scheme is adopted and asymptotic solutions are presented as they are needed to compute the solution in the proximity of the end points. The second method considers the solution as an initial value problem. The 4-fold indeterminacy which arises when the solution is started from the point where the independent variable is zero, is shown to be reducible to a 2-fold one. The 2 parameters left are related to the attainment of the required asymptotic behavior of the solution.

Polytechnic Inst. of Brooklyn, N. Y.
TRANSONIC ROTATIONAL FLOW OVER A CONVEX CORNER, by Roberto Vaglio-Laurin. Rept. on Contract AF 49(638)217. Aug 59, 66p. 12 refs. PIBAL rept. no. 431; AFOSR-TN-59-355; AD-213 681.
Order from LC mi$3.90, ph$10.80 PB 144 381

A singularity is encountered in the flow field about two-dimensional and axisymmetric bodies characterized by a sharp corner, where the fluid velocity becomes sonic. Such is the case for several practical configurations in transonic and hypersonic flow. An investigation of this sonic singularity, and the application of results thereof to the analysis of flow fields about blunt bodies in the aforementioned category are presented. It is shown that the problem in question, as many other discontinuity problems, belongs to the family of asymptotic or boundary layer phenomena of mathematical physics. The solution of the first approximation equations is given by a series in powers of a variable measuring the distance from the corner with coefficients depending on an appropriate similarity variable. The leading coefficient of the series is independent of three-dimensional and rotationality effects, in complete analogy to the well-known solution of the corner problem in supersonic flow. Detailed results are presented for the leading singularity and for the first two corrections due to rotationality and axial symmetry of the flow.

Rome U. (Italy).
EXPERIMENTAL INVESTIGATION ON DELTA WING AND COMPLETE CONFIGURATION MODELS FOR AEROELASTIC SIMILARITY PROBLEMS AT SUPERSONIC BLOW DOWN WIND-TUNNEL, by Luigi Broglio, Carlo Buongiorno and others. Technical note no. 7 on Contract AF 61(514)888. Mar 59, 60p. 3 refs. SIARgraph no. 50; AFOSR-TN-59-954.
Order from LC mi$3.60, ph$9.30 PB 144 304

The experimental techniques for the aeroelastic investigation at the supersonic blow down wind tunnel are presented. Wind tunnel data at M = 3.01 on triangular wing model are given in. These results show the small importance of the chordwise deflection of the section on the aerodynamic characteristics. An experimental investigation at M = 3.12 on a complete airplane configuration is presented, showing the importance of the parameter $\frac{P_0}{E}$ on the lateral stability derivatives. In the Appendix of the report the preliminary design of a magnetic support for dynamic stability tests is presented.

Rome U. (Italy).
RESEARCH ON AEROELASTICITY, by Luigi Broglio. Final rept. on Contract AF 61(514)888. May 59, 12p. SIARgraph no. 51; AFOSR TR-59-134; AD-226 438.
Order from LC mi$2.40, ph$3.30 PB 144 297

Research is reported on the following: (a) modeling technique and theory for aeroelastic similarity in blow-down wind tunnel tests; (b) developing technique and an experimental device to study the same problems of point (a) but including dynamic effects; (c) finding exact solutions of the problem of the heat conduction in heterogeneous solids with boundary conditions function of space and time.

Technische Hochschule, Munich (West Germany).
SUPERSONIC FLOW PAST OSCILLATING BODIES OF REVOLUTION WITH A FREQUENCY NOT NECESSARILY SMALL, by Johann Muench. Technical note no. 8 on Contract AF 61(514)1080. 24 June 59, 13p. 3 refs. AFOSR-TN-59-452; AD-215 027.
Order from LC mi$2.40, ph$3.30 PB 143 965

This report gives a representation of the potential of linearized flow past bodies of revolution executing elliptic oscillations of arbitrary frequency. The potential is given in terms of BESSEL- and LEGENDRE-functions.

University of Southern California. Engineering Center, Los Angeles.
ANALYTICAL STUDY OF THE HEATING OF HYPERSONIC AIR FLOW BY ELECTRODE-LESS HIGH-FREQUENCY DISCHARGE, by James C. Williams, III, Paul C. Wilber, and Raymond L. Chuan. [Final rept.] on Contract AF 40(600)736. Oct 59, 75p. 24 refs. USCEC rept. 68-101; AEDC-TR-59-23.
Order from LC mi$4.50, ph$12.30 PB 143 921

The possibility of heating a supersonic gas stream by means of electrode-less high-frequency discharge is studied. This heating scheme logically can be divided into two parts: the discharge where energy is added to the gas stream and stored as potential energy of electron-ion separation, and the decay where the electrons and ions recombine and give up some of the separation energy as thermal energy of the gas. Qualitative consideration of the discharge phase indicates the necessary relations between the electric field parameters, the hydrodynamic parameters and the chamber dimensions for an efficient discharge. Both qualitative and quantative discussions of the decay are given, the latter of which yields the variation of the hydrodynamic variables in the decaying flow. Finally, in the latter portion of

this report, it is shown how high-frequency electrode-less discharge heating might be applied practically to the heating of a low density, high Mach number, wind tunnel gas stream.

Hydrodynamics, Hydraulics, and Hydrostatics

Indiana U., Bloomington.
A MATHEMATICAL EXAMPLE DISPLAYING FEATURES OF TURBULENCE, by Terence Butler. Rept. for 1 Sep 54-31 July 58 on Contract AF 33(616)2550. Mar 59, 75p. 16 refs. WADC Technical rept. 59-52; AD-213 590.
Order from OTS $2.00 PB 151 969

The Navier-Stokes equations have proven to be the proper description for laminar flow, but no solutions of these equations resembling turbulence have been found. Thus, the question arises whether a set of straightforward equations like the Navier-Stokes equations can have solutions of such complex nature as would be necessary to describe turbulent flow. An answer to this question is suggested by Dr. Eberhard Hopf who has contrived a set of equations which retain certain essential features of the Navier-Stokes equations, but which are much simpler. He has shown that these equations have very complex solutions, actually random functions, qualitatively similar to the velocity in turbulent phenomena. The present report explores Hopf's approach in further detail. The properties of turbulent flow as obtained in measurements are expressed by certain statistical averages. The present report investigates the corresponding quantities of Hopf's model by means of probability theory and thus establishes a basis for a more detailed comparison. It is found that the broader characteristics of turbulence are present in the solutions but that the inherent simplicity of Hopf's model limits the extent of the similarity. For example, the velocity has a normal distribution as in turbulence, but the probability distribution of the difference of the velocity at two points close together fails to exhibit the small but important deviations from the normal distribution that are found in turbulent flow. The results suggest the value of seeking to devise another set of equations which would be a step closer to the Navier-Stokes equations.

Rensselaer Polytechnic Inst., Troy, N. Y.
THE STABILITY OF VISCOUS FLOW BETWEEN ROTATING CONCENTRIC CYLINDERS WITH A PRESSURE GRADIENT ACTING ROUND THE CYLINDERS, by R. D. DiPrima. Rept. on Contract Nonr-591(12). 21 Jan 59, 18p. 10 refs. RPI MathRep no. 20.
Order from LC mi$2.40, ph$3.30 PB 144 116

In this paper the stability of a viscous fluid between concentric cylinders is analyzed, when the basic velocity distribution is the sum of a velocity distribution due to the rotation of the cylinders, Taylor (1923) and a "pumping" velocity distribution due to a pressure gradient acting round the cylinders, Dean (1928). The critical Taylor number is computed for a wide range of values of the ratio of average velocity of pumping to average velocity of rotation in the case that the outer cylinder is stationary. It is assumed that the spacing between the cylinders is small.

Technische Hochschule, Hannover (West Germany).
EFFECTS OF LONG-PERIOD WAVES IN HARBORS, by W. Hensen. Final technical rept. for 1 July 58-30 June 59 on Contract DA 91-508-EUC-355. [1959] 413p. 53 refs.
Order from LC mi$11.10, ph$63.60 PB 144 262

This report presents the results of basic model tests of the occurrence of resonant oscillations in harbor basins induced by long-period waves. The objectives of the experiments were to find out practicable means suitable for minimizing to a satisfactory degree the effects of resonant amplifications which, in most cases, are dangerous for shipping and harbor operations. Out of the numerous possibilities applicable to improve the nautical and operational conditions in harbors subject to long-period waves, the insertion of transversal moles of different lengths and groupings was selected for studies. The effects of such transversal moles on the vertical and horizontal water motions in a basin were investigated experimentally. The utilization of transversal moles for this purpose is considered serviceable because the moles simultaneously may be of use for harbor operations.

METALLURGY

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF COBALT-BASE ALLOYS, by John J. Rausch. Summary rept. for 1 July 57-31 Aug 58 on Contract NOas-58-136-c. 29 Oct 58, 61p. 4 refs.
Order from LC mi$3.90, ph$10.80 PB 144 136

In an intensive study of the potentialities of all useful cobalt-base binary alloy systems, approximately 200 alloy compositions were studied. The individual alloying elements have been classified, both empirically and quantitatively, as to their effects on the parameters forgeability, ductility, elevated temperature strength, and oxidation resistance. Two distinct classes of strong cobalt-base alloys have evolved. One of these contains chromium with the addition of molybdenum, tantalum, or niobium either singly or in combination. The other type is composed of combinations of molybdenum, tantalum, or niobium.

Commonwealth Engineering Co. of Ohio, Dayton.
DEVELOPMENT OF A METHOD TO ACCOMPLISH ALUMINUM DEPOSITION BY GAS PLATING, by Malvern J. Hiler and William C. Jenkin. Rept. for 16 June 58-16 Dec 59 on Materials Applications, Contract AF 33(616)5594. June 59, 64p. 3 refs. WADC Technical rept. 59-88; AD-214 887.
Order from OTS $1.75 PB 151 923

The deposition of aluminum was accomplished by thermally decomposing vapors of tri-isobutyl aluminum on the surface of cleaned, heated copper test panels in a heated plating chamber. The test panels were subjected to a preliminary deoxidation by induction heating to 800°F on a hydrogen atmosphere, purging the chamber with argon gas while cooling the sample to 500 degrees, then admitting a mixture of gases containing tri-isobutyl aluminum vapors for varying periods. The plate produced is substantially pure aluminum, lustrous and ductile, of excellent conductivity, and in thickness up to 4.7 mils. Adhesion varied from poor to excellent.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
SOME METALLURGICAL CONSIDERATIONS IN FORGING MOLYBDENUM, TITANIUM, AND ZIRCONIUM, by Harry B. Goodwin. 25 Mar 59, 43p. DMIC memo. 12.
Order from OTS $0.50 PB 161 162

Reasons for the current interest in molybdenum, titanium, and zirconium are outlined briefly and typical uses are cited. The forging of each metal is discussed separately. In each case the metallurgy of the metal is reviewed briefly and the effect of the metallurgical characteristics on forging practice is explained. Practical hints on forging each metal are also given.

Minerals Research Lab., U. of California, Berkeley.
HEATS OF FORMATION OF Au_3ZN AND AuZn, by Ray W. Carpenter, Raymond L. Orr, and Ralph Hultgren. Technical rept. no. 3 on Contract DA 04-200-ORD-171, T. O. 15. 1 Oct 59, 18p. 15 refs. Series no. 126, issue no. 3; OOR rept. 2287.3 met
Order from LC mi$2.40, ph$3.30 PB 144 478

The heats of formation of gold-zinc alloys of compositions Au_3Zn and AuZn were measured at various temperatures. At the composition Au_3Zn the best X-ray diffraction data indicate the disordered fcc α phase decomposes on cooling below 693°K to a complex ordered α_1 phase, which on further cooling below 543°K decomposes to form a second ordered α_2 phase. Heat contents and heats of formation show that (AuZn (β') has no tendency to disorder on heating to 800°K.

Minerals Research Lab., U. of California, Berkeley.
THE HEATS OF FORMATION OF SILVER-PALLADIUM ALLOYS, by John P. Chan (Master's thesis) Philip D. Anderson and others. Technical rept. no. 4 on Contract DA 04-200-ORD-171, T. O. 15. 1 Oct 59, 21p. 12 refs. Series no. 126, issue no. 4; OOR rept. 2287.4 met.
Order from LC mi$2.70, ph$4.80 PB 144 483

Heats of formation of five silver-palladium alloys at 330°K. The skewing observed in these heats of formation when plotted versus the composition has been interpreted in terms of the filling of the vacant 0.6 orbital in the 4d shell of palladium which is completed at 60 atomic percent of silver.

New York U. Coll. of Engineering, N. Y.
THE GRAIN BOUNDARY ADSORPTION OF SOLUTES, by J. Winter and S. Weinig. Final rept. on Contract Nonr-285(22). Dec 57, 43p. 12 refs. AD-153 300.
Order from LC mi$3.30, ph$7.80 PB 138 075

The grain boundary adsorption of solutes was studied using internal friction techniques. The segregation of alloying elements to the grain interfaces was studied as a function of both the bulk concentration and the solution temperature. Interaction energies in the range of 0.3 ev were obtained. This value was used to obtain the actual concentration of solute at the grain boundary. In corroboratory creep studies the direct grain boundary contribution to the total creep strain was measured. It was found that the interface creep varied with the type and magnitude of the solute adsorbed.

Rock Island Arsenal Lab., Ill.
SPECTROGRAPHIC STANDARDS FOR THE ANALYSIS OF ALUMINUM AND MAGNESIUM ALLOYS, by L. H. Moorhead. 19 Nov 58, 30p. 7 refs. Rept. no. 58-3208; AD-210 518.
Order from LC mi$2.70, ph$4.80 PB 144 385

Methods were set up for the X-ray analysis of aluminum alloys for several elements in high concentration ranges where the accuracy of this method exceeds that of optical emission spectroscopy. Optical spectrographic methods were developed for the analysis of aluminum alloys and magnesium alloys. The analytical curves, spectrum lines and complete operating conditions are shown. A statistical study proved the optical spectrographic methods to be accurate and standard comparison samples to be homogeneous.

Rodman Lab., Watertown Arsenal, Mass.
DESIGN AND OPERATION OF A TUBE TYPE LABORATORY VACUUM FURNACE, by Francis S. Delacey. Apr 59, 12p. 5 refs. Technical rept. no. RPL 41/9; AD-225 374.
Order from LC mi$2.40, ph$3.30 PB 144 322

A laboratory furnace was designed and assembled for use in the vacuum firing of compacted, powdered metal specimens. The furnace assembly includes a refractory mullite tube in which the specimens are fired, a pumping system, a graphite susceptor, and auxiliary instruments for registering pressure and temperature within the furnace tube. The power source for inductively heating the susceptor is a high-frequency spark gap converter. In normal operation, the furnace accommodates the equivalent of six 3" x 3/8" square, pressed compacts. Vacuums of 10^{-4}mm Hg and temperatures of 1400°C (2552°F) are reached in approximately two and one-half hours when titanium powder compacts are being fired. On the basis of preliminary firings, it is concluded that the furnace can be profitably utilized in evaluating vacuum sintering techniques.

Crucible Steel Co. of America, Syracuse, N. Y.
DEVELOPMENT OF A DUCTILE, OXIDATION-RESISTANT, LOW-DENSITY ALLOY SYSTEM FOR INTERMEDIATE TEMPERATURE USE, by R. C. Gibson and P. Lillip. Final rept. for 26 June 58-26 June 59 on Contract NOas-58-848-c. 26 Aug 59, 43p.
Order from LC mi$3.30, ph$7.80 PB 144 134

Development of an age-hardenable Fe-Al-Mn-C alloy with low density, good oxidation resistance, high strength, and good ductility at intermediate temperatures (1100 to 1400 F). Development of a stable, age hardenable austenitic alloy possessing excellent room temperature strength and good elevated temperature strength with oxidation resistance at 1800 F approaching that of Type 304.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
FABRICATION OF 17-7PH AND PH15-7Mo STAINLESS STEEL BY BEND ROLLING, DEEP DRAWING, AND SPINNING, by C. T. Olofson. 15 May 59, 5p. DMIC memo. 18.
Order from OTS $0.50 PB 161 168

James Forrestal Research Center, Princeton, N. J.
SELF-DIFFUSION IN ALPHA IRON, by C. Ernest Birchenall and Richard J. Borg. Rept. on Contract AF 49(638)533. Oct 59, 19p. 12 refs. Metallurgy rept. no. 20; AFOSR-TN-59-1085; AD-227 069.
Order from LC mi$2.40, ph$3.30 PB 144 006

The self-diffusion coefficients for α-iron have been determined between 980°C to 1167°K using Fe^{55} as the tracer. In the temperature region beginning at least 50°C above T_C the diffusion coefficient is given by $D = 118 \pm 2) \exp(-67240/RT) cm^2 sec^{-1}$.

Michigan U. Research Inst., Ann Arbor.
EFFECT OF PRIOR CREEP ON SHORT-TIME MECHANICAL PROPERTIES OF 17-7PH STAINLESS STEEL (RH 950 CONDITION COMPARED TO TH 1050 CONDITION) by Jeremy V. Gluck and James W. Freeman. Rept. for 1 Jan 58-31 Mar 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3368. Oct 59, 91p. 6 refs. WADC Technical rept. 59-339.
Order from OTS $2.25 PB 161 296

The effect of creep to 2 percent in 100 hours at temperatures from 600° to 900°F was determined on the tension, compression, and tension-impact properties of 17-7 PH(RH 950 Cond.) at room temperature or the exposure temperature. A substantial loss in ductility was observed in room temperature tension tests. Material exposed to creep at 600°F exhibited a substantial Bauschinger effect in tension and compression tests. The loss in ductility is attributed to stress and/or temperature induced aging during the creep-exposure.

Naval Weapons Plant, Washington, D. C.
EFFECTS OF CADMIUM PLATING THICKNESSES AND OVERLAYING UPON THE RECOVERY FROM HYDROGEN EMBRITTLEMENT OF AISI 4340, by S. V. Chek. 21 Sep 59, 20p. NAVORD rept. 6944; NWPW-T-27-59.
Order from LC mi$2.40, ph$3.30 PB 144 120

Recovery from hydrogen embrittlement at the 270,000 psi strength level by baking at 300°F was determined. Two procedures were used for the detection and evaluation of hydrogen embrittlement: the unnotched tensile test and the notched sustained load, static fatigue, test. Recovery was attained, at baking times within 4 hours when the cadmium plating ranged from 0.5×10^{-4} to 1.25×10^{-4} inch but recovery was unattained at commercial thicknesses of, or in excess of, 2.5×10^{-4} inch. Subsequent replating embrittled the steel.

Rodman Lab., Watertown Arsenal, Mass.
FACTORS AFFECTING DEPHOSPHORIZATION AND DESULPHURIZATION IN BASIC-ELECTRIC STEEL PRODUCTION, by John Zotos. Apr 59, 23p. 13 refs. Rept. no. RPL 10/18; AD-220 627.
Order from LC mi$2.70, ph$4.80 PB 143 947

Statistical analyses of equilibrium steelmaking data indicated that good correlation was obtained when: (1) the dephosphorizing power (P)/[P] = (percent phosphorus in the slag)/[percent phosphorus in the metal] was a logarithmic function of a slag parameter equal to the product of the slag's basicity $(\%CaO)/(\%SiO_2)$ times its oxidizing power (%FeO), and (2) the desulphurizing power (S)/[S] = (percent sulfur in the slag)/[percent sulfur in the metal] was a logarithmic function of a slag parameter equal to the quotient of the slag's basicity divided by its oxidizing power. Slag and metal compositions existing during the production of 4140, high nickel 4325, 4330 and 1040 AISI basic-electric steels were statistically analyzed using the same relationships. The results indicate that the dynamic (or non-equilibrium) dephosphorizing and desulphurizing powers of basic-electric slags are lower than their corresponding equilibrium values, and can be estimated at stage of a heat using the following equations: $(P)/[P] = 0.776 [(\%CaO)(\%FeO)/(\%SiO_2)]^{0.69}$ and $(S)/[S] = 10.38 [(\%CaO)/(\%SiO_2)(\%FeO)]^{0.48}$. These equations reveal that maximum dephosphorization and desulphurization conditions cannot exist simultaneously during basic-electric steel production due to the opposite effect of the slag's oxidizing power in the two slag parameters.

Rutgers State U., New Brunswick, N. J.
INHIBITION OF HYDROGEN EMBRITTLEMENT DURING PICKLING, by Donald B. Denney and Leonard Bauerman. Quarterly progress rept. no. 13, 1 Jan-31 Mar 59, on Contract DA 30-069-ORD-1689. [1959] 17p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 144 392

Preparation and study of compounds which are to be used in determining the mechanism of the action of hydrogen embrittlement inhibitors on steel in an acid pickling bath. The compounds which have been

synthesized are structurally related to DHQ, one of the active ingredients in the reference standard inhibited hydrochloric acid.

Watertown Arsenal Labs., Mass.
INFLUENCE OF TEMPERATURE ON THE TENSILE AND FRACTURE PROPERTIES OF HIGH PURITY VACUUM MELTED IRON, by Harold G. Carter. Aug 58, 18p. 6 refs. Rept. no. WAL TR 330.3/1.
Order from LC mi$2.40, ph$3.30 PB 144 051

Specimens were tensile tested at +200°F, -319°F. At a testing temperature of liquid nitrogen (-319°F) the transgranular cleavage-type fracture was predominating. The ductility values approached zero. In addition, the microstructure contained many mechanical twins, which are believed to be found in very low temperature strained ferrite in nearly pure iron.

Watertown Arsenal Labs., Mass.
MECHANICAL PROPERTIES OF AISI 4340 STEEL IMPROVED BY CONSUMABLE-ELECTRODE VACUUM REMELTING, by Serge Cvikevich. Sep 59, 55p. 14 refs. Technical rept. no. WAL TR 310.1/1.
Order from LC mi$3.60, ph$9.30 PB 143 946

A slight improvement of impact properties due to consumable-electrode process remelting was observed in the material which was tempered in the upper tempering range. Marked improvement in fatigue properties was observed for samples tempered in the lower, as well as upper tempering ranges. An improvement in ductility properties was observed throughout the tempering range studied.

Light Metals

Chance Vought Aircraft, Inc., Dallas, Tex.
EVALUATION OF NEW HIGH STRENGTH TITANIUM SHEET ALLOYS, by J. W. Seeger and S. G. Young. Quarterly progress rept. no. 3, 1 July-30 Sep 58, on Contract NOas 58-104c. 31 Oct 58, 7p. CVA rept. no. E8R-11719.
Order from LC mi$1.80, ph$1.80 PB 138 472

Chart showing work schedule time table on this contract. Brief of current status.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
BAND SAWING OF TITANIUM AND TITANIUM ALLOYS, by Carl T. Olofson. 1 July 59, 15p. 12 refs. DMIC memo. 23.
Order from OTS $0.50 PB 161 173

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
BELT GRINDING OF TITANIUM SHEET AND PLATE, by Carl T. Olofson. 15 Mar 59, 8p. 5 refs. DMIC memo. 11.
Order from OTS $0.50 PB 161 161

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
EFFECTS OF HIGH STRAIN RATES AND RAPID HEATING ON THE TENSILE PROPERTIES OF TITANIUM ALLOYS, by F. R. Schwartzberg. 29 Dec 58, 33p. 7 refs. DMIC memo. 4.
Order from OTS $0.50 PB 161 155

The test data available allow the following generalizations to be drawn: (1) Yield and tensile strength increase with increasing strain rate; this behavior is most pronounced at temperatures above the present service limits of the subject alloys. Retention of strength to higher than normal temperatures can be achieved by testing at very high strain rates. (2) Ductility generally decreases with increasing strain rate. (3) Modulus of elasticity is not significantly affected by strain rate. (4) Holding time has no effect on tensile properties of titanium alloys annealed to a stable condition, except for losses in ductility due to surface oxidation at extremely high temperatures.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
HACKSAWING OF TITANIUM AND TITANIUM ALLOYS, by Carl T. Olofson. 6 July 59, 13p. 5 refs. DMIC memo. 24; AD-220 194.
Order from OTS $0.50 PB 161 174

Titanium and its alloys can be hacksawed under cutting conditions adapted to the behavior of titanium. The difficulties encountered in other machining operations are also present in sawing. They include galling, smearing, abrasiveness, and the generation of high temperatures in the cutting zone. During the sawing process, a tiny chip forms as each saw tooth penetrates the work. Chips gradually enlarge and curl into each tooth gullet as the blade moves through the cut. The chips remain trapped in the gullets until the teeth emerge from the kerf. At that time, chips either fall out or are flushed out by the cutting fluid directed into the cutting zone. The objectives in hacksawing include straightness of cut, smoothness of cut surface, ample cutting rates, and reasonable tool life. Appropriate selections of pitch, speeds, and feeds not only should minimize the sawing difficulties of titanium, but also should create an economic balance between cutting rate and blade life. Cutting rates for titanium are about 25 to 50 per cent lower than those associated with quenched and tempered alloy steels of equivalent hardness. Blade life in terms of productivity is about 50 per cent lower than that with alloy steels of equivalent hardness.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
JOINING OF BERYLLIUM, by N. E. Weare and R. E. Monroe. 30 Mar 59, 28p. 16 refs. DMIC memo. no. 13.
Order from OTS $0.50 PB 161 163

Beryllium is a brittle metal and is difficult to fabricate and join. Limited success has been reported on direct welding by tungsten-arc, pressure, and electron-beam processes. Good joints have been made by braze welding with aluminum filler and brazing with silver and the silver-copper eutectic alloy.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE MACHINING OF BERYLLIUM, by C. T. Olofson. 5 June 59, 16p. 10 refs. DMIC memo. 21.
Order from OTS $0.50 PB 161 171

Beryllium machines like cast iron, but is more abrasive to tools. Its brittle behavior can cause spalling at the exit of cuts and cracking at the surface. During machining, pieces of built-up edge slough off the tool, causing a scuffed, machined appearance. Carbide tools are normally used for turning, milling, and drilling at speeds up to 250, 150, and 100 surface feet per minute, respectively. The recommendation of the Atomic Energy Commission that "for the present it is safest to regard beryllium metal and all its compounds as potentially toxic" is the guiding principle in beryllium safety. Beryllium should be machined in an easy-to-clean, isolated area. The AEC recommendation for a safe beryllium-in-air concentration is 2.0 micrograms or less per cubic meter. Chemical pneumonitis in some persons working with beryllium has been attributed to suspended solid particles or mists of beryllium, its compounds, or solutions of soluble beryllium compounds. Chip cleanliness is required to maintain the maxium salvage value of beryllium. Cutting fluids are often omitted to prevent chip contamination.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
NITRIDING OF TITANIUM, by J. W. Holladay. 12 Aug 59, 13p. 26 refs. DMIC memo. 29; AD-225 299.
Order from OTS $0.50 PB 161 179

Contents:
Thermodynamic and kinetic considerations of nitriding titanium
Nitriding media
Nitriding procedures
Nitriding titanium with nitrogen gas
Nitriding with ammonia gas
Effect of alloy composition of nitriding
Nature of the nitride coating
Properties of the nitride coating

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PHYSICAL AND MECHANICAL PROPERTIES OF TANTALUM, by H. R. Ogden. 28 Aug 59, 19p. 27 refs. DMIC memo. 32; AD-225 589.
Order from OTS $0.50 PB 161 182

The physical properties of tantalum, having been the subject of numerous investigations during the past 50 years, are well established. Some selected physical properties are presented in Table 1, and specific physical properties at various temperatures are given in Tables 2 through 8. The mechanical properties of tantalum, especially at elevated temperatures, have become of marked interest during recent years. Unfortunately, complete information is not yet available. Table 9 presents the room-temperature tensile properties of tantalum in various commercial forms. Tables 10 and 11 present the tensile properties of tantalum sheet and rod, respectively, at subzero, room, and elevated temperatures. The properties of tantalum at temperatures of 3000 to 5000 F are given in Tables 12 through 15. The effect of oxygen contamination on the tensile strength of tantalum at about 4530 F is shown by the data in Table 16.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PREPARATION AND ANALYSIS OF TITANIUM-HYDROGEN STANDARD SAMPLES, by Max J. Trzeciak. Rept. on Contract AF 18(600)1375. 9 Feb 59, 14p. DMIC memo. 9.
Order from OTS $0.50 PB 161 160

Titanium-hydrogen standard samples were prepared individually from degassed titanium rods. The hydrogen was added to the degassed titanium sample in a modified Sieverts apparatus. Battelle analyses of 20 standards were in good agreement with the amounts of hydrogen added. Analytical results of 24 samples by two outside laboratories were in excellent agreement with the amounts of hydrogen added. Eight standard samples analyzed by two other laboratories were in excellent agreement with the amounts of hydrogen added, eight analyses were in good agreement, and six analyses showed poor agreement. Twelve samples were run by the spectrographic technique. The results showed that there is a degree of agreement between the standard samples and the spectrographic results.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PROFILE MILLING TITANIUM AND ITS ALLOYS, by Carl T. Olofson. 10 July 59, 4p. 2 refs. DMIC memo. 25; AD-220 195.
Order from OTS $0.50 PB 161 175

Profile milling is a method of milling in which the path of a single-spindle cutter is guided and controlled by a stylus tracing a master form or a template made to the contour, shape, or pattern to be reproduced on the workpiece. When profile milling titanium and its alloys, vibrations must be held to an absolute minimum. Vibrations, when present, are induced in the cutter stylus and hence are reproduced at the cutter spindle. These add to any vibrations already present at the cutter. The result is poor tool life, even fracture of harder cutter materials such as carbides.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
RECENT ADVANCES IN TITANIUM TECHNOLOGY, by E. W. Cawthorne and W. Stuart Lyman. 24 Oct 58, 34p. 2 refs. DMIC memo. 3.
Order from OTS $0.50 PB 161 154

Growth of commercial applications of titanium has been steady and careful. This usage can be expected to grow steadily and without fluctuation. Quality of mill products has continued to improve over recent months. Production brazing of titanium is still to be developed, but intensive research is underway. Titanium prices have continued to decline, although dramatic reductions have not occurred and are not to be expected. Titanium continues to have great promise in military aircraft and missile applications as a re-

sult of its weight-strength superiority over alternate materials and its superior corrosion resistance. Four major developments now underway will reinforce and augment these advantages offered by titanium. (1) Development of uniformly heat treatable high-strength alloy sheet (2) Development of sandwich construction techniques (3) Development of processing procedures and equipment to broaden the spectrum of forms and shapes in which titanium alloys are available (thin sheet, extrusions, castings) (4) Development of weldable alloys which will maintain useful strength up to 1000-1100 F and of alloys with room temperature strength of 200,000 psi, or greater.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
ROUTING OF TITANIUM SHEET, by C. T. Olofson. 12 June 59, 6p. 3 refs. DMIC memo. 22.
Order from OTS $0.50 PB 161 172

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
SOME NOTES ON SAFE HANDLING PRACTICES FOR BERYLLIUM, by Webster Hodge. 22 Sep 58, 14p. 5 refs. DMIC memo. 2.
Order from OTS $0.50 PB 161 153

The rapid development of missiles systems has resulted in the introduction of beryllium metal into many machine shops, fabricating plants, and laboratories that have had no prior experience with this metal. It is generally known that beryllium and its compounds are highly toxic. The recommendations of the U. S. Atomic Energy Commission for control of beryllium hazards are also quite well known. However, many contractors appear to be somewhat puzzled about the practical steps necessary to stay within the limits of air contamination recommended by the AEC. The information that follows is based on a limited number of literature references, and a still more limited series of observations by DMIC personnel of shops in operation. No recommendations for safe handling of beryllium in setting up a new operation are intended or can be given in this report. However it is hoped that these references and brief descriptions may assist safety engineers, operators, and plant design groups in the task of setting up a reasonable program of safe handling practices to be adhered to in any shop that expects to handle beryllium for the first time.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THERMAL PROPERTIES OF TITANIUM AND TITANIUM ALLOYS, by J. W. Holladay. 25 Aug 58, 24p. 50 refs. DMIC memo. 1.
Order from OTS $0.50 PB 161 152

This memorandum contains available data on the thermal properties of titanium and titanium alloys. The properties covered are thermal conductivity, thermal expansion, heat capacity, thermal diffusivity, and emissivity. Methods are given for estimating values for these properties when experimental data are not available.

Minerals Research Lab., U. of California, Berkeley.
ACTIVATION ENERGIES FOR CREEP OF AN ALPHA SOLID SOLUTION OF MAGNESIUM IN ALUMINUM, by N. R. Borch, L. A. Shepard, and J. E. Dorn. Technical rept. no. 6 on Contract Nonr-222(49). 15 Feb 58, 35p. 29 refs. Series no. 103, issue no. 6; AD-157 760.
Order from LC mi$3.00, ph$6.30 PB 138 470

The activation energies for creep of an Al-3.2% Mg alloy were studied over a temperature range from 78°K to the melting point. With the exception of a temperature region from 200° to 380°K where locking effects and periodic yielding were observed, the activation energies for the alloy are the same as those previously reported for pure Al. Within this temperature region, however, an activation energy peak greater than 80,000 cal. /mole was obtained at 325°K, and creep became unmeasurably slow.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
EFFECTS OF SHORT PERIODS OF INTERMITTENT VERSUS CONTINUOUS HEATING ON THE ROOM TEMPERATURE TENSILE PROPERTIES OF 2024-T4 ALUMINUM ALLOY SHEETS, by H. R. Pritchard. Technical rept. Sep 59, 13p. 1 ref. Memo. rept. M60-4-1.
Order from LC mi$2.40, ph$3.30 PB 144 237

Tensile properties and hardness were determined at room temperature on sheet specimens of 2024-T4 aluminum alloy which had been exposed to continuous and intermittent heating at 400° F for total periods of 2 to 16 hours. The effects of intermittent heating were cumulative and resulted in the same properties as produced by continuous heating. In both instances, the tensile strength decreased to 80 percent of the room temperature value after 16 hours at 400° F, while the yield strength decreased to 95 percent in the longitudinal direction and 90 percent in the transverse direction. After shorter periods at elevated temperature, the yield strength increased because of the occurrence of artificial aging.

Nonferrous (except light) Metals

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE AVAILABILITY AND PROPERTIES OF RHENIUM, by Daniel J. Maykuth. 22 May 59, 12p. 9 refs. DMIC memo. 19.
Order from OTS $0.50 PB 161 169

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
ELEVATED-TEMPERATURE MECHANICAL PROPERTIES AND OXIDATION RESISTANCE OF COLUMBIUM AND ITS ALLOYS, by, F. R. Schwartzberg and W. D. Klopp. 4 Feb 59, 12p. 28 refs. DMIC memo. no. 8.
Order from OTS $0.50 PB 161 159

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
IMPLICATIONS OF RHENIUM RESEARCH IN THE DESIGN OF REFRACTORY ALLOYS, by R. L. Jaffee. 2 Feb 59, 4p. DMIC memo. 7.
Order from OTS $0.50 PB 161 158

There appear to be three effects of rhenium in molybdenum which are responsible for its unique behavior. There are: oxygen redisposition, twinning, and unlocking of dislocations. By combination of elements we might provide complex alloys with the same behavior, which now seems to be unique for rhenium as a binary alloying element. Even if complexing of more abundant alloying elements fails to produce the effects of rhenium in improving the ductility of molybdenum and tungsten, the scientific value of the studies on rhenium will be considerable.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PHYSICAL AND MECHANICAL PROPERTIES OF MOLYBDENUM AND THE Mo-0.5Ti ALLOY, by Richard W. Douglass. 10 Apr 59, 23p. 18 refs. DMIC memo. 14.
Order from OTS $0.50 PB 161 164

Some physical properties of molybdenum and the Mo-0.5Ti alloys of interest in the elevated temperature applications of these materials are briefly summarized. Mechanical properties, including tensile, impact and fatigue data and creep and stress-rupture properties over a wide range of temperatures are also presented.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE PROPERTIES OF MAGNESIUM-THORIUM ALLOYS, by R. J. Jackson. 29 May 59, 29p. 13 refs. DMIC memo. 20.
Order from OTS $0.50 PB 161 170

It is the purpose of this memorandum to present available engineering data for magnesium-thorium alloys of interest for structural applications of high-speed manned aircraft, which are commercially produced or have reached an advanced developmental stage. In addition, limited attention is given to fabrication of the alloys and design requirements that favor their selection.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE STATUS OF CHROMIUM-BASE ALLOY DEVELOPMENT, by Daniel J. Maykuth. 30 Jan 59, 8p. 3 refs. DMIC memo. 6; AD-210 737.
Order from OTS $0.50 PB 161 157

Massachusetts Inst. of Tech., Cambridge.
CHROMIUM BASE ALLOYS, by H. L. Levingston and N. J. Grant. Technical rept. on Contract NOas-58-253-d. 1 Oct 58, 24p. 17 refs.
Order from LC mi$2.70, ph$4.80 PB 144 135

The brittle to ductile transition temperature of commercial electrolytic chromium was investigated. Elements with a high affinity for oxygen, nitrogen and carbon were added to the chromium. The reaction products which formed and their effect on several properties of chromium were correlated with ductility criteria. The investigation showed that the transition temperature of chromium, as determined by three point bend tests, can be lowered by deoxidation and denitrification techniques as well as by grain size refinement and by testing at reduced strain rates.

Structural Metallurgy and Corrosion

Army Chemical [Warfare] Labs., Army Chemical Center, Md.
CORROSION RESISTANCE OF METALS TOWARD ISOPROPYL METHYLPHOSPHONOFLUORIDATE (GB), by A. Stephens Hutchcraft, Jr., Virgil D. Mochel, and Lawrence C. Buckles. Special rept. 27 May 55, declassified 10 Dec 56. 12p. CRLR-510.
Order from LC mi$2.40, ph$3.30 PB 144 127

A summary of studies on the corrosion of various metals by GB (isopropyl methylphosphonofluoridate) a chemical warfare agent.

Battelle Memorial Inst., Columbus, Ohio.
MATERIALS-PROPERTY-DESIGN CRITERIA FOR METALS. PART 8. THE CREEP BEHAVIOR OF SELECTED MATERIALS IN THE RANGE UP TO 1 PER CENT NET CREEP STRAIN AND 1000 HOURS, by R. J. Favor, W. P. Achbach, and H. J. Grover. Rept. for 15 Aug 58-31 Jan 59 on Materials Application, Contract AF 33(616)3965. Sep 59, 30p. 21 refs. WADC Technical rept. 55-150, Pt. 8.
Order from OTS $0.75 PB 161 302

The objectives of this study were to compile and to evaluate creep strain versus time data on airframe structural materials. The range of interest, as recommended by the Elevated Temperature Task Group of the ANC-5 Panel, includes creep strain up to 1 per cent and time up to 1000 hours. Only two reference sources dealt with creep of airframe structural materials within the conditions of strain and time imposed. Although both of these sources have considerably extended the knowledge of creep behavior in the early stages of creep, it appears that neither has encompassed adequately the regions of interest specified. Reasons for this conclusion are discussed in this report. It should be emphasized that for creep strain above about 1 per cent, both sources of data appear adequate. (See also PB 131 515)

Case Inst. of Tech., Cleveland, Ohio.
RESEARCH ON STRAIN AGING EFFECTS IN TITANIUM, by Harold S. Gurev and William M. Baldwin, Jr. Rept. for May 58-May 59 on Metallic Materials, Contract AF 33(616)5691; Continuation of Contract AF 33(616)3536. Sep 59, 70p. 54 refs. WADC Technical rept. 59-223.
Order from OTS $1.75 PB 161 304

The effects of varying interstitial element content

(oxygen, carbon and nitrogen) on the tensile properties of an alpha-beta titanium alloy, Ti-140A, were determined at test temperatures ranging from room temperature to above 1000°F and at strain rates from 0.05 to 19,000 in/in/min. The stress rupture properties of such alloys and similar interstitial bearing modifications of an alpha alloy, A-110AT, were also determined between 400°F and 1000°F. The tensile properties of the alpha-beta modifications were strongly dependent on the nitrogen content alone, while the appearance of a strain rate dependent high temperature embrittlement in an alloy modification heat was governed by the identity of the principal interstitial present. (See also PB 131 381)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE INFLUENCE OF SHEET THICKNESS ON TENSILE PROPERTIES OF METAL SHEET, by Alfred Rudnick and Robert L. Carlson. 23 Jan 59, 19p. 18 refs. DMIC memo. 5.
Order from OTS $0.50 PB 161 156

A review of the literature on the effect of specimen geometry indicates that the percentage total elongation increases as some power of the product of specimen thickness and width. Thus, it is possible to combine the effects of thickness and width into a single parameter -- cross-sectional area. No significant influence of thickness on strength apparently exists. Consideration of the correlation between laboratory measurements and actual useful ductility leads to the conclusion that uniform elongation may be a more significant index of ductility than is the more commonly used total elongation.

Forest Products Lab., Madison, Wis.
DEVELOPMENT OF A CASE LINER FOR LONG-TERM OUTDOOR STORAGE (FINAL REPORT), by Louetta Dieruf and Donald J. Fahey. Aug 59, 29p. 2 refs. Rept. no. 55-2 (Final); DA Proj. no. 591-07-001.
Order from LC mi$2.70, ph$4.80 PB 144 386

This report summarizes four annual examinations of case liners and their contents, which were in wood shipping containers exposed outdoors at four locations representing a wide range of climatic conditions. Liners, contents, and boxes were examined for rupture corrosion, warping, and general deterioration. Based on these annual appraisals, liner C (1-mil aluminum foil laminated between a 3-mil polyethylene film and 44/40 cotton scrim) can be used satisfactorily in protecting metal items against corrosion for at least 4 years of outdoor exposure in a wide range of climates. Linear A (2-mil polyethylene film sandwiched between two sheets of 60-pound creped kraft paper and coated on one surface with a 2-mil polyethylene film) and liner B (3-mil polyethylene film on a 60-pound kraft paper) will be limited to hot and arid climates, such as Yuma, Ariz., and to areas that have moderate precipitation with below-freezing temperatures most of the year, such as Fort Churchill, Canada. These liners cannot be used for even 1 year in humid climates like the Panama Canal Zone and Madison, Wis. The Douglas-fir containers offered better protection to the liner and its contents than boxes made from oak or southern pine. Treatment of the southern yellow pine box with a water-repellent preservative was advantageous when the box was exposed in areas with a high atmospheric moisture content.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
CELLULAR STRUCTURE IN ZINC CRYSTALS GROWN FROM THE MELT, by Victor V. Damiano and Marvin Herman. Rept. on Contract AF 18(600)1581. Aug 59, 23p. 10 refs. Interim rept. I-A1878-4; AFOSR-TN-59-765.
Order from LC mi$2.70, ph$4.80 PB 144 015

Substructure in zinc single crystals resulting from constitutional supercooling was examined. The effect of orientation on the cell structure arrangement is described in terms of preferred growth directions.

Illinois U., Urbana.
THE EFFECTS OF INELASTIC ACTION ON THE RESISTANCE TO VARIOUS TYPES OF LOADS OF DUCTILE MEMBERS FROM VARIOUS CLASSES OF METALS. PART XI. PHOTOELASTIC ANALYSIS OF I-BEAMS WITH ELLIPTIC-TYPE WEB CUTOUTS, by Will J. Worley. Rept. on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5658. Sep 59, 27p. 6 refs. WADC Technical rept. 56-330, Pt. XI.
Order from OTS $0.75 PB 161 303

The data presented are intended to supplement the data presented in WADC TR 56-330 Pt. VII (PB 131 556). Report VII presented information on the fully plastic strength while Pt. XI discusses the elastic stress distribution in the web section of I-beams with various shapes of elliptic-type web cutouts. The prediction of the location of the fully plastic hinges using the shear difference method is discussed for one shape of web cutout. The method shows reasonable agreement when compared with available data on the actual aluminum alloy I-beam.

Industrial Research and Development Labs. (Gt. Brit.)
MECHANISM OF CORROSION OF COPPER AND COPPER ALLOYS BY AMMONIA SOLUTIONS WITH SPECIAL REFERENCE TO THE INHIBITORY ACTION OF SUGARS AND OTHER POLYHYDROXY COMPOUNDS, by J. A. Radley and J. S. Stanley. Final technical rept. for 1 Oct 58-1 Oct 59 on Contract DA 91-591-EUC-930. 31 Oct 59, 66p. 10 refs.
Order from LC mi$3.90, ph$10.80 PB 144 137

The investigation is a continuation of the investigation described in our previous report. It concerns the study of the mechanism of the reaction between metallic copper and ammonia solutions containing dissolved oxygen. An apparatus for measuring the kinetics of this reaction has been constructed, based on the use of a rotating disc, this apparatus shows considerable advantage over the rotating cylinders.

Manufacturing Labs., Inc., Cambridge, Mass.
DEVELOPING SUBSTITUTE BINDERS FOR COBALT IN WC-Co ALLOYS AND STUDYING THE EFFECT OF GRAIN SIZE OF WC ON THE STRENGTH OF WC-Co ALLOYS, by Harry Udin. Final rept. on Contract DA 19-020-505-ORD-4482. 30 June 58, 69p. 9 refs. Rept. no. WAL 330/16.
Order from LC mi$3.90, ph$10.80 PB 144 050

The optimum iron content of WC-Fe hot pressings, with or without additions of Si or B, is in the range of 4 to 5 wt. pct. Fe. Iron-silicon alloy binders containing 2.4-5.0 wt. pct. Si yield good quality pressings. Iron-boron alloy binders containing 0.02 to 1.0 wt. pct. B yield good quality pressings.

Modena U. (Italy).
BASIC RESEARCHES IN METAL CORROSION, by Giuseppe Bianchi. Technical final rept. on Contract AF 61(052)85. 30 Apr 59, 11p. AFOSR-TR-59-76.
Order from LC mi$2.40, ph$3.30 PB 144 122

The electrochemical processes of O_2 and H_2O_2 on platinum, graphite and gold electrodes have been studied, to get a knowledge of the mechanism of oxygen corrosion. The process of oxygen and hydrogen periozide reduction in alkaline solutions takes place, independently of the nature of the cathode, at tensions very near the reversible one corresponding to the process: $O_2 + H^+ + 2e = HO_2^-$.

Massachusetts Inst. of Tech., Cambridge.
THE GROWTH OF $Ni_3(Al, Ti)$ PRECIPITATES IN A NICKEL-CHROMIUM-TITANIUM-ALUMINUM ALLOY, by Neil Rogen and Nicholas J. Grant. Technical rept. on Contract NOas 58-253-d. [1959] 12p. 9 refs.
Order from LC mi$2.40, ph$3.30 PB 144 059

X-ray line broadening was used as a measure of precipitate particle growth during aging of a vacuum melted alloy. The variation of matrix lattice parameter, precipitate composition and hardness was related to the particle size.

Michigan U. [Research Inst.] Ann Arbor.
DEVELOPMENT OF APPARATUS AND METHODS FOR MEASUREMENT OF CREEP AT TEMPERATURES TO 3500°F, by M. J. Sinnott. Progress rept. no. 3. 25 Oct 48, 8p. NEPA 803-MIC-3; AD-204 943.
Order from LC mi$1.80, ph$1.80 PB 138 457

Michigan U. [Research Inst.] Ann Arbor.
DEVELOPMENT OF APPARATUS AND METHODS FOR MEASUREMENT OF CREEP AT TEMPERATURES TO 3500°F, by M. J. Sinnott. Progress rept. no. 5. 23 Dec 48, 13p. NEPA 864-MIC-5; AD-204 969.
Order from LC mi$2.40, ph$3.30 PB 138 460

Three of the four types of furnaces that were proposed for this project have been constructed and tested for various time periods and at various temperature levels. Work on the Geiger counter method of temperature measurement shows that this device is probably more accurate than the usual optical pyrometer with the sensitivity actually improving as the temperature is raised. An improved extensometer system has been evolved which practically eliminates creep in the specimen threads and has a sensitivity on the order of two-millionths of an inch per inch and should be applicable to 1800°C or 3250°F. (See also PB 138 457)

Michigan U. [Research Inst.] Ann Arbor.
DEVELOPMENT OF APPARATUS AND METHODS FOR MEASUREMENT OF CREEP AT TEMPERATURES TO 3500°F, by M. J. Sinnott. Progress rept. no. 6. 21 Jan 49, 10p. NEPA 886-MIC-6; AD-204 968.
Order from LC mi$1.80, ph$1.80 PB 138 461

The creep testing machine and extensometer system reported in the fifth progress report have been built and tested at room temperature. Work on the Geiger tube temperature measuring instrument has been proceeding satisfactorily. A simple molybdenum wound furnace has been developed and given service for over 150 hours at a temperature of 2700°F. (See also PB 138 460)

Northwestern Technological Inst., Evanston, Ill.
AN INVESTIGATION OF PHASE TRANSFORMATIONS AND OTHER STRUCTURAL CHANGES IN METALS BY MEASUREMENT OF ELASTICITY AND INTERNAL FRICTION, by M. E. Fine and A. Kelly. Final rept. for 1 June 55-31 Aug 59 on Contract AF 18(600)1468. 30 Sep 59, 51p. 25 refs. AFOSR-TR-59-141.
Order from LC mi$3.60, ph$9.30 PB 144 008

Apparatus for precise determination of dynamic young's modulus and internal friction at elevated temperatures; Kinetics and mechanism of zone formation in aluminum alloys; Studies of the deformation of single crystals of age hardened aluminum alloys; Structural and modulus changes in α-brass and $AuCu_3$; Acoustic relaxation effect in Mn_3O_4; Internal friction and young's modulus of hexagonal and cubic cobalt; Preparation of single crystals.

Ohio State U. Research Foundation, Columbus.
ELECTRONIC ENERGY BAND STRUCTURE AND EXCITATION STATES IN METALS, by J. Korringa, E. L. Jossem and others. Technical rept. no. 6 on Contracts N6onr-22521 and AT(11-1)-191. May 57, 35p. 23 refs. AD-139 131.
Order from LC mi$3.00, ph$6.30 PB 137 906

Electronic energy band structure and excitation states in metals are discussed under the following topics: (1) Band structure and excitation states in nickel, copper, and zinc, (2) Structures of the zirconium lines, (3) Report on the grating vacuum spectrometer, and (4) Corrections for self-absorption in the X-ray tube target. Theoretical and experimental data are discussed under the first topic. The study of the structures of zirconium lines was made before it was discovered that the structure on the high-frequency side of Zr L γ_1 is caused by minute quantities of sulfate evaporated from the hot oxide cathode. However, the material was retained because of the possibility that such a study may add to the understanding of metallic alloying processes. The report on the grating vacuum spectrometer considers the problem of contamination.

Rock Island Arsenal Lab., Ill.
GUIDE FOR PRACTICAL PRESERVATION WITH VCI, by Ralph L. LeMar. 6 July 59, 30p. 3 refs. Rept. no. 59-1820.
Order from LC mi$2.70, ph$4.80 PB 144 387

VCI literature was surveyed for information which would provide packaging engineers with the detailed data that was necessary to utilize more readily, volatile corrosion inhibitors. This information was organized into sections so as to permit ready reference to any appropriate section. These sections are as follows: (A) Official documents relative to VCI. (B) General application fundamentals. (C) Environmental effects. (D) VCI compatibility: (1) Among different VCI materials. (2) With bearings. (3) With nonferrous metals. (4) With surface coatings and plates. (5) With nonmetals.

Watertown Arsenal Labs., Mass.
THE EFFECT OF CERIUM ON THE HEAT TREAT RESPONSE OF PRECIPITATION-HARDENING TITANIUM ALLOYS, by Ralph H. Hiltz, Jr. Apr 58, 25p. 11 refs. Technical rept. WAL TR 401/285; AD-157 339.
Order from LC mi$2.70, ph$4.80 PB 138 417

A study was made of the effect found in combining the weak precipitation-hardening alloys of titanium, Ti-Ag, Ti-Cu, and Ti-Si, with the more intense precipitation-hardening but hot-short Ti-Ce alloys. The three ternary alloys, Ti-Ag-Ce, Ti-Cu-Ce, and Ti-Si-Ce, showed appreciable precipitation-hardening response. The Ti-Si-Ce ternary showed a double peaking of hardness with aging. A portion of the response in this alloy was due to precipitation of elemental cerium, however, which indicates a hot-short material. The addition of cerium to the Ti-Ag alloy moved peak hardness to shorter times, and maximum hardness to a lower temperature. There is no alleviation of the rapid aging and overaging cycle characteristic of the binary silver alloy, and control of the hardening reaction is difficult. The alloy of titanium with copper and cerium showed pronounced precipitation hardening and a slow overaging reaction. This alloy shows promise of being suitable for commercial application.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

National Research Labs., Ottawa (Canada).
THE PREDICTION OF PIPELINE PRESSURE LOSSES WITH URANIUM TRIOXIDE SUSPENSIONS, by E. H. Dudgeon and W. C. Michie. Nov 57, 56p. 13 refs. Rept. MT-36.
Order from LC mi$3.60, ph$9.30 PB 134 228

Measurements of pipeline pressure losses for uranium trioxide aqueous suspensions have been made for two pipe diameters and a range of velocities, oxide concentrations, and temperatures. These results have been correlated using shear rate-shear stress information obtained from a specially designed rotational viscometer. The effect of pumping at high shear rates on the chemical and physical stability of the oxide has been investigated. The limiting velocity to avoid settling in a 1.85-inch diameter pipe has been measured.

New Mexico U., Albuquerque.
SIZE-SPECTRUM OF EXTENSIVE AIR SHOWERS OF THE COSMIC RADIATION, by John R. Green and James R. Barcus. Rept. on Contract AF 49(638)34. 7 Oct 59, 16p. 8 refs. AFOSR-TN-59-1068.
Order from LC mi$2.40, ph$3.30 PB 144 342

The operation and calibration of a single scintillator of area 7.3 m^2 is discussed.

Elementary Particles

Laval U. (Canada).
RESEARCH ON THE AUGER ELECTRONS ASSOCIATED WITH BETA-DISINTEGRATION, by Claude Geoffrion. Final rept. on Contract AF 18(600)1574. 31 Aug 59, 54p. 26 refs. AFOSR-TR-59-145.
Order from LC mi$3.60, ph$9.30 PB 144 007

This is a study of the energy of the electrons emitted by atoms when they reorganize themselves after vacancies have been made in their shells due to electron-conversions or electron-captures. This effect gives electron lines, the energy of which depends on the reorganizing process and on the atomic number of the emitter. These lines range from zero to a maximum of 80 kev, but are mainly in the low energy region. The experimental determination of Auger electron energy has been made with a 180° β-ray spectrometer. Theoretical work has been done and each part is reported separately in the following.

Maryland U., College Park.
HYPERFRAGMENT FORMATION FROM THE K^--DEUTERON INTERACTION IN FLIGHT, by T. B. Day, G. A. Snow, and J. Sucher. Rept. on Contracts AT(40-1)2504 and AF 49(638)24. [1959] 9p. 6 refs. Physics Dept. technical rept. no. 154; AFOSR-TN-59-1072.
Order from LC mi$1.80, ph$1.80 PB 144 343

The results show that the hope of observing hyperfragment formation in deuterium bubble chambers is not bright.

Michigan U., Ann Arbor.
PHOTOGRAPHY OF COSMIC RAY TRACKS WITH A CASCADE LUMINESCENT CHAMBER, by Lawrence W. Jones and Martin L. Perl. Luminescent Chamber Technical rept. no. 1 on Contract Nonr-1224(23). 24 Dec 58, 24p. 8 refs.
Order from LC mi$2.70, ph$4.80 PB 143 933

The tracks of minimum ionizing particles have been

photographed in a luminescent chamber for what is believed to be the first time. A cascade luminescent chamber made up of three image tubes coupled with refractive optics has been used to photograph tracks of cosmic ray μ mesons in a sodium iodide crystal. The apparatus is described, together with details of measurements on image tube characteristics and the nature of background. The same type of apparatus is applicable to other problems where very weak light signals (several thousand photons total) must be photographed.

Princeton U., N. J.
DETERMINATION OF THE SIGN OF THE ASYMMETRY PARAMETER IN Δ^0 DECAY FROM THE SCATTERING OF THE DECAY PROTON, by T. Bowen, C. R. Sun, and A. E. Werbrouck. Technical rept. no. 21 on Contract Nonr-1858(06). 3 Dec 58, 19p. 13 refs.
Order from LC mi$2.40, ph$3.30 PB 143 864

A statistical method is presented whereby the information provided by a small number of nuclear scatters of Δ^0 decay protons can be used to determine the sign of the asymmetry parameter due to parity non-conservation in Δ^0 decay. The analysis is applied to twenty-one proton scatters of Δ^0 hyperons decaying in the Princeton multiplate cloud chamber. Because the asymmetry to be expected in each observed nuclear scatter is small, our data do not yield a statistically significant result. However, if each experimenter would follow a similar procedure with his data, it should be possible to combine results to determine the sign with a high degree of certainty.

Purdue U., Lafayette, Ind.
POLARIZATION OF THE PROTON FROM PHOTODISINTEGRATION OF THE DEUTERON, by Masaaki Kawaguchi. Rept. on Contract AF 18(600)1579. [1958] 23p. 13p. AFOSR-TN-58-584; AD-162 104.
Order from LC mi$2.70, ph$4.80 PB 137 434

The transverse polarization of the outgoing proton from the photodisintegration of the deuteron is calculated in the angular momentum representation, without assuming any detailed interaction among particles. General formulas for the polarization as well as for the angular distribution are given in terms of the Racah coefficients. If we write the angular distribution in a form $a + b \sin^2 0 (1 + 2c \cos 0)$, the polarization is given in terms of a, b, c, and the nucleon-nucleon scattering phase shifts of the S, P, and D states under reasonable assumptions. By using experimental values of a, b, and c, and scattering phase shifts as much as available and also some theoretical estimates of the phase shifts, 20 to 30% polarization is expected for up to 40 Mev gamma rays and 10 to 20% for 140 Mev gamma rays over a wide range of angles in the center of mass system.

Instruments and Installations

Eagle-Picher Research Labs., Miami, Okla.
RESEARCH ON GROWING OF CADMIUM SULFIDE CRYSTALS FOR DOSIMETER PURPOSES, by J. E. Powderly and K. E. Bean. Quarterly rept. no. 2, 17 July-17 Oct 57, on Contract DA 36-039-sc-73270. [1957] 50p. 8 refs. AD-154 774.
Order from LC mi$3.30, ph$7.80 PB 137 661

Single crystals of Cds weighing up to 100 g were produced. The test specimens obtained from the larger single crystals and from crystals having the least number of visible physical defects, were the most sensitive to γ rays and gave more reproducible results. A small concentration of In (0.001 to 0.004% of weight) increased the sensitivity of the crystals to γ rays. IR quenching prior to irradiation decreased the sensitivity of the crystals and caused longer rise times. A crystal prepared from very high purity CdS with no addition agents, had remarkable sensitivity to IR. Seeding at 1100°C, and when cooling, lowering the temperature slowly to 100°C and retaining that temperature for 24 hr, were favorable conditions for crystal growth.

Montana State U., [Bozeman].
ELECTRON LINEAR ACCELERATOR LABORATORY, by Mark J. Jakobson. Annual summary rept. for 1 Jan 58-1 Jan 59 on Contract Nonr-1662(00), [1959] 9p.
Order from LC mi$1.80, ph$1.80 PB 144 443

Summary of results of 1 year of research. Montana State University has a traveling wave electron linear accelerator with a 3.2 ft. two section cavity. The beam emerging from the analyzer magnet has an energy spread of 50 kev at 5 mev and an average current of 1.0 microamperes.

Naval Radiological Defense Lab., San Francisco, Calif.
A FIELD BETA-GAMMA DOSE-RATE METER, by Frank A. Devlin. May 57, 14p. Research and Development Technical rept. USNRDL-TR-178; AD-145 732.
Order from LC mi$2.40, ph$3.30 PB 144 396

A thin polyethylene chamber ionization detector has shown remarkable beta flux sensitivity. It was found that by adding a removable beta flux discriminator to the chamber it was practicable to differentiate between the beta component and the gamma component of the flux coming from a contaminated field. Laboratory experiments and field data substantiate the practicability of the system described. The gamma energy dependence of the detector was found to be a maximum of 17 percent high relative of Co^{60}.

Nuclear Reactions

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
ANALYTIC WAVE FUNCTION. III. THE SPIN-ORBIT, SPIN-OTHER ORBIT AND SPIN-SPIN INTERACTIONS, by R. G. Breene, Jr. Rept. on Contract AF 04(647)269. 20 Oct 59, 20p. 7 refs. R59SD414.
Order from LC mi$2.40, ph$3.30 PB 144 190

In two earlier papers we have described our methods and programs for calculations of certain classes of atomic wave functions. In this paper we consider the application of the wave functions so obtained to the calculation of the spin-orbit, spin-other orbit, and spin-spin interactions. These calculations remove the horizontal degeneracy from the Slater diagram. We assume the Coulomb potential for the spin-orbit calculation and show the relative contributions of the nucleus and other type electrons to the result. In this and the succeeding interactions oxygen is used as an example. Although the order of the splitting is as observed, the observed asymmetry is not obtained, for the sum of all three effects is a symmetric splitting of the three levels. An explanation of this lack of asymmetry is offered which appeals to our neglect of the exchange portion of the potential in the spin-orbit calculation.

Boston U., Mass.
AN EXPERIMENTAL STUDY OF THE REACTION $Al^{27}(d, n)Si^{28}$, by Allen G. Rubin. Doctoral thesis. Rept. on [Contract AF 18(600)997], 1957, 137p. 98 refs. AFOSR-TN-57-636; AD-136 623.
Order from LC mi$6.90, ph$21.30 PB 137 528

The neutron spectrum and angular distributions of neutron groups from the reaction $Al^{27}(d, n)Si^{28}$ were obtained by the method of proton recoils in nuclear emulsions. A thin Al target was bombarded with 2.16 -Mev deuterons from the M. I. T. Rockefeller Van de Graaff generator, and neutrons were detected by means of 400-μ Ilford C-2 emulsions placed at 9 angles to the incident beam. The plates were scanned with a Leitz binocular microscope equipped with a moving stage, at 1000 magnification. Neutron spectra were obtained at 8 angles from 0^{o} to 120^{o}. A total of 12,500 tracks was scanned. Excited states of Si^{28} were obtained from these measurements from 1.78 $\pm$ 0.10 to 10.25 $\pm$ 0.06 Mev. The cross-section for formation of the 9.37 state of 0^{o} is 10.1 millibarns per steradian, within a factor of 2. A second bombardment for the same reaction was made with a bombarding energy of 6.00 Mev to obtain valid stripping angular distributions; emulsions were placed at 9 angles to the incident beam, at 15^{o} intervals, from 0^{o} to 135^{o}. The angular distributions which were obtained were compared with the Butler stripping theory to obtain the parities and limits on the spins of the states in Si^{28} which were reached in the reaction. A thin target of isotopic boron was bombarded with 7.03 Mev protons. The neutrons from the $B^{11}(p, n)C^{11}$ reaction indicated an excited state of C^{11} at 2.01 $\pm$ 0.06 Mev. The reaction $P^{31}(p, n)S^{31}$ was studied at E_p $\pm$ 17.2 Mev. The energy spectrum of the neutrons was determined by means of proton-recoil measurements in nuclear emulsions. The mass excess (M - A) of S^{31} was calculated to be -10.04 $\pm$ 0.20 Mev. Excited states of S^{31} were located at 1.15 $\pm$ 0.15, 2.28 $\pm$ 0.20, 3.35 $\pm$ 0.20, 4.51 $\pm$ 0.15, 5.94 $\pm$ 0.30, and 6.41 $\pm$ 0.20 Mev.

Pennsylvania U., Philadelphia.
STUDIES IN PHOTONUCLEAR REACTIONS. Rept. on Contract AF 49(638)454. 15 Oct 59, 15p. 27 refs.
Order from LC mi$2.40, ph$3.30 PB 144 475

Reviews findings and publications covering their research.

Radioactivity

Army Chemical Warfare Labs., Army Chemical Center, Md.
SURVIVAL IN FALLOUT AREAS, by Harold E. Shaw. Feb 59, 39p. 6 refs. CWLR-2272.
Order from LC mi$3.00, ph$6.30 PB 143 739

This report attempts to summarize, amplify, and clarify the current information available, and to present it in such form that it can be readily applied by doctrinal agencies.

General Electric Research Lab., Schenectady, N. Y.
THRESHOLD MEASUREMENTS AND THE PRODUCTION OF RADIATION DAMAGE IN THE NOBLE METALS, by J. W. Corbett and R. M. Walker. Scientific rept. no. 2 on Contract AF 19(604)5557. Oct 59, 7p. 9 refs. AFCRC-TN-59-764.
Order from LC mi$1.80, ph$1.80 PB 144 199

It is shown that the threshold energy T_d for radiation damage production in Cu, Ag, and Au is 22, 30, and $\geq$ 40 ev respectively. The fact that the T_d values are not the same for this homologous series of metals requires a reconsideration of deuteron radiation damage theory and experiment comparison. This shows that even beyond the different T_d values, the noble metals are not identical as far as the damage process.

Naval Ordnance Lab., White Oak, Md.
PROCEDURES FOR COUNTING AND HANDLING LOW ACTIVITY FOILS, by Donald G. Simons. 26 Aug 57, 14p. 6 refs. NAVORD rept. 5698.
Order from LC mi$2.40, ph$3.30 PB 144 040

When determining low activities in radioactive foils, the optimum time for counting activity is 1.8 half-lives. The background count should be made over a period at least four times that long. Special precautions are discussed for avoiding foil contamination and systematic errors in accumulating data from several experiments.

Stevens Inst. of Tech., Hoboken, N. J.
LITERATURE SURVEY ON THE EFFECTS OF NUCLEAR RADIATION TO ELECTRON TUBE MATERIALS, by E. R. Johnson. Quarterly rept. no. 7, 1 Dec 58-28 Feb 59, on Contract DA 36-039-sc-73146. [1959] 21p. 18 refs.
Order from LC mi$2.70, ph$4.80 PB 143 897

It is recommended that studies on the effect of nuclear radiation in aging, in reference to shock and vibration be undertaken. The effect of nuclear radiation on cold cathodes is very much greater than on hot cathodes. The mechanism of reduction of cathode material by hydrogen is discussed.

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

[Aerospace] Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
DEVELOPMENT OF AN EMERGENCY PRESSURE SUIT (COVERALLS, HIGH-ALTITUDE, TYPE CSU-4/P) by Charles C. Lutz. Rept. on Pressure Suits and Accessories. Prototype garments developed at the David Clark Co. under Contracts AF 33(616)3329 and AF 33(600)36873. July 59, 26p. 7 refs. WADC Technical note 59-148; AD-226 056.
Order from OTS $0.75 PB 161 033

The design of coveralls, high-altitude, Type CSU-4/P attempts to correct operational deficiencies in presently available garments as to comfort, mobility, heat, ease of donning, fitting, and integration with other flight clothes. The requirements of the pressure suit were established, and seven prototype models were designed, each improving on the previous model. The outer layer of the most recent suit is orange in color as an aid to rescue operations. This suit will provide physiological protection for a large segment of the flying population for the times and altitudes required of such a garment (70,000 ft. for 5 minutes). Improved comfort and mobility are achieved in the unpressurized condition, and tolerable comfort and adequate mobility are maintained while pressurized. Present testing of the capabilities of the new garment and continued plans of the program are described.

George Washington U., Washington, D. C.
THE LOGISTICS OF CLOSE SUPPORT, by J. E. Hamilton. Rept. on Logistics Research Project, Contract Nonr-761(05). Jan 59, 110p. 1 ref. Serial T-86/59.
Order from LC mi$5.70, ph$16.80 PB 144 261

The Logistics of Close Support considers all of naval logistics as coming to an end within the confines of a ship. It relates the demands which arise within the ship to the ways and means of satisfying those demands. Ship logistics support starts with a man in a job on a ship and with the tools which he has and the things which he uses, and works its way through a tortuous path to the laying-in hospital, and the forest, the mine, the sea and the air. It embraces EVERYTHING except men's thoughts, the ideas which spring from these and the actions of the thinker or of others under his control which carry these ideas into purpose.

Quartermaster Research and Engineering Center, Natick, Mass.
ENVIRONMENTAL PROTECTION RESEARCH BY MEANS OF RADIO TELEMETRY, PART 1. TELEMETRIC INSTRUMENTATION AND EXAMPLES OF FIELD USE IN STUDYING THE MAN-CLOTHING-ENVIRONMENT SYSTEM, by Francis W. Botsch, James J. Powers, and Alfred A. Koch. Oct 59, 31p. 27 refs. Technical rept. EP-119.
Order from LC mi$3.00, ph$6.30 PB 144 203

This report describes a frequency-type radio telemeter and associated automatic data reduction equipment designed to sense, transmit, and reduce biophysical data obtained from soldiers performing military-type activities during field exercises. The system consists of a transducer-transmitter section which is carried by the test subject, a receiving and recording unit which is located at the test site, and a laboratory data-reduction system. The telemeter permits remote recording of temperature, pressure, relative humidity, air movement, heart rate, and breathing rate with provision for converting transmitted data into analog or digitized readout or into a form adaptable to IBM computation. Data are presented to show the effect of variations in environmental factors such as wind and radiation on the man and his clothing. Graphs are used to illustrate the manner in which thermal variations at the outer surface of the clothing are modified and delayed by the clothing system and the response of the man-clothing-environment system to physiological conditions accompanying exercise.

Wayne-George Corp., Boston, Mass.
HIGH-SPEED, ELECTROMECHANICAL GOGGLE. Rept. on Visual Aids and Protection, Contract AF 33(616)5287. May 59, 29p. WADC Technical rept. 59-114; AD-215 828.
Order from OTS $0.75 PB 151 924

High-speed, electromechanical goggles, which were developed and constructed to protect the eyes of the wearer from burns or flashblindness caused by exposure to high-intensity flashes, are described. A signal is generated by a photodetector at the onset of the flash. This signal is amplified by an electronic amplifier and actuates the shutters of the goggles to shut out all light. The goggles are closed in less than 500 microseconds after the flash.

PHYSICS

Cornell U., Ithaca, N. Y.
A STUDY OF A PLATINUM SURFACE USING A MASS SPECTROMETER, by Richard C. Bradley. Technical rept. no. 11 on Theoretical and Experimental Investigations of the Atomic Phenomena Occur-

ring on and near the Surface of Solids, Contract AF 18(600)674. 1 May 59, 58p. 20 refs. AFOSR-TN-59-271; AD-212 705.
Order from LC mi $3.60, ph$9.30 PB 144 215

The mass spectrometric analysis of particles ejected from a metal surface by the impact of inert gas ions provides information on sputtering, on surface and bulk compositions, and on surface and bulk kinetics[1-3]. Formation of PtO_3 on the Pt surface and its subsequent removal, either by evaporation or by ion bombardment.

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
PROGRESS REPORT NO. XXIV, by A. von Hippel. Rept. on Contracts Nonr-1841(10), AF 30(635)2872, and AT (30-1)1937. Jan 59, 70p. 15 refs.
Order from LC mi$3.90, ph$10.80 PB 144 445

Contents:
Dielectric Spectroscopy
Magnetic Resonance
High Field-Strength Research
High-Pressure Research
Layer and Surface Studies
Semiconductors
Ferromagnetics
Single Crystals
Ceramics

New York U., N. Y.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. Quarterly progress rept. no. 8 (Final) for Nov [56]-Jan [57] on Contract DA 36-039-sc-64526. Apr 57, 55p. 10 refs.
AD-129 921.
Order from LC mi$3.60, ph$9.30 PB 137 530

Self-quenching in different types of molecules: The fluorescence of solutions containing 2 solutes of rather similar fluorescent properties and various chemical properties was measured and compared with the fluorescence of each when present alone in solution. Studies were conducted under high-energy excitation. Anthracene and 2 of its derivatives were chosen to check what happens when substances more closely related structurally as well as in fluorescence properties are combined. The results of anthracene combined with 9-methylanthracene and anthracene combined with 2-methylanthracene revealed a difference in behavior in these 2 combinations. Energy transfer in plastics: A 0.12 M quencher of di-p-tolylmercury reduced the fluorescence of a 0.05 M solution of 2,5-diphenyloxazole by a factor of 2. Decay of fluorescence excited by high energy and light: Fluorescence decay times of organic materials of the order of 10^{-9} to 10^{-7} sec were measured. De-excitation investigations on ZnS and ZnCdS phosphors: Experiments were undertaken to examine the effect of $\lambda \geq 7700$ A, heat, and time on the de-excitation process. Exposure to $\lambda \geq 7700$ A or to heat at 100°C for longer than 60 min contributed practically nothing further to the trap emptying process. Uncooled samples reached temperatures as high as 110°C during IR irradiation while cooled samples were maintained at about 10° to 15°C. Heat acts to empty electrons from traps, while IR acts to free positive holes which recombine either with electrons in the conductivity band or in traps. The difference between the so-called quenching and stimulable phosphors is essentially in the nature of the recombination process. (See also PB 135 930)

Acoustics

Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SOUND RADIATION IN A CLOSED SPACE FROM BOUNDARY LAYER TURBULENCE, by Ira Dyer. Rept. on Contract Nonr-2321(00). 12 Feb 58, 47p. 20 refs. Rept. no. 602.
Order from LC mi$3.30, ph$7.80 PB 144 115

A theory of noise generation by the action of boundary layer turbulence on an elastic system has been developed, with particular reference to underwater application. The elastic system considered is a rectangular plate closed off by a rectangular liquid-filled volume. A simple yet physically meaningful form is assumed for the boundary layer pressure correlation. The resulting plate vibration and sound radiation is derived, taking into account coupling between the plate motion and the sound field in the liquid. In the theory coupling is manifested by radiation-induced masses and viscous damping which, in effect, may be added to the mass and damping of the plate considered to be vibrating in vacuo. It is shown that the noise in the closed space decreases with decreasing free-stream speed and boundary layer thickness. Also the noise decreases with increasing mass and damping of the plate, and with increasing distance from the plate. The use of plate damping as a means of noise reduction is predicted to be limited on the one hand by radiation damping, and on the other hand by correlation decay in the assumed turbulence pressure field.

California U., Los Angeles.
ABSORPTION OF ULTRASONIC WAVES IN ROTATIONAL ISOMER LIQUIDS OF THE RING TYPE, by Melvin Eli Pedinoff. Technical rept. no. 14 on Contract Nonr-233(48). Jan 59, 78p. 39 refs.
Order from LC mi$4.50, ph$12.30 PB 144 139

The ultrasonic pulse technique has been extended to lower frequencies by the use of solid dielectric transducers and has been used here for the determination of the anomalous absorption of sound in several organic liquids over a frequency range of approximately 150 to 3,500 kilocycles per second. The principal liquid studied, methylcyclohexane, has a large anomalous sound absorption which can be attributed to the irreversible perturbation of an equilibrium between two of its rotational isomers by the sound wave.

Harris Transducer Corp., Woodbury, Conn.
THE THEORY OF ACOUSTIC REFLECTORS FOR SONAR APPLICATIONS. REPORT 1. RESPONSE OF AN END LOADED CYLINDRICAL RESONATOR, by H. K. Farr. Rept. on Contract Nonr-2720(00). 15 Jan 59, 25p. 1 ref. HTC-73-R1.
Order from LC mi$2.70, ph$4.80 PB 144 398

This report is the first in a program for the study of passive devices for the reflection or scattering of sound energy in deep water. The object of the general program is to develop alternatives to the conventional low density baffle materials (cork, "cell-tite", etc.) which fail at very high hydrostatic pressures. The first device selected for study was a hollow right circular cylinder with a mass attached to each end. A sound wave exerts radial pressure on the walls which induces lengthwise motion of the end masses owing to the so-called Poisson ratio coupling. In the region of resonance such a device offers the possibility of an efficient reflector or scatterer of sound energy.

Electricity and Magnetism

Carnegie Inst. of Tech., Pittsburgh, Pa.
THE TWO HALL EFFECTS OF IRON-COBALT ALLOYS, by Frank P. Beitel, Jr. and Emerson M. Pugh (Summary of Research). Final rept. on Contract Nonr-760(04). 31 Dec 58, 97p. 18 refs.
Order from LC mi$5.40, ph$15.30 PB 143 980

Hall coefficients and resistivities of the Fe-Co alloys measured at 77°K, 169°K, and room temperature using fields up to 3.3 weber/m^2.

Michigan U. Research Inst., Ann Arbor.
GALVANO-MAGNETIC EFFECTS. PART I, by W. Tantraporn and Ernst Katz. Final rept. on Contract AF 49(638)69. Aug 59, 54p. 15 refs. 2613-8-F; AFOSR-TR-59-122, AD-226 081.
Order from LC mi$3.60, ph$9.30 PB 144 121

An historical preface is given. The phenomenological theory, as developed previously, is summarized, with special emphasis on applications to bismuth and gallium. The experimental method of measurement and results for bismuth are described. It is found that all resistivity brackets can be represented by the formula $\{\} = \Gamma_0 T e^{-\beta} \sqrt{T}$, where Γ_0 is a constant, different for each bracket and β depends almost exclusively on the order of the bracket. This dependence is roughly given by $\beta_n = 2n/(n+4)$. Results from the literature for gallium are analyzed in terms of our phenomenological constants. The procedure of testing and its complications are sketched, as is the direction in which an entire new series of bracket relations is in process of being discovered by the present analysis. Comparison of limiting low-intensity reciprocity failure slope from sequence loops is made with previous measurements. A study is made of the number of quanta active in the formation of a just developable latent image as a function of grain size, density, and type of development by means of sequence loops. The method of sequence exposures is briefly described along with experimental results. The results confirm qualitatively the trend of the theoretical work but lead to quantitative difficulties, which are discussed. The conclusions are summarized.

Naval Research Lab., Washington, D. C.
RESONANCE ABSORPTION OF MICROWAVE BY PARAMAGNETIC SUBSTANCES, by Chihiro Kikuchi and Walter W. Wada. Final rept. 22 Sep 52, 70p. 31 refs. NRL rept. 4015.
Order from LC mi$3.90, ph$10.80 PB 143 880

A brief theoretical background for the interpretation of one of the most important phenomenon in paramagnetism—namely, resonance absorption of microwaves by paramagnetic salts. The results of these calculations in the case of hyperfine structure and specific heat for cupric salts are compared with experimental observations and found to be in excellent agreement.

Electronics

Air Force Cambridge Research Center, Bedford, Mass.
A SURVEY OF THE RESEARCH OF IONIZED MEDIA, by E. Atlee Jackson. Aug 59, 33p. 167 refs. AFCRC-TR-59-174.
Order from LC mi$3.00, ph$6.30 PB 144 382

The purpose of this article is to survey that literature which sheds light on either the dynamical or equilibrium properties of ionized media. While an attempt has been made to compile a fairly complete listing of the pertinent research, it is not intended to be exhaustive and some important papers may have been inadvertently overlooked. This survey has been arranged in chronological order, to the extent that this does not conflict with the conceptual development of the subject. The early development of this subject lends itself quite well to such an ordering. More recent developments, by their very nature, are more difficult to place in a logical order and are arranged somewhat arbitrarily as to subject matter. The brief discussions of this research attempt to point out some of the areas of controversy, incompleteness, and errors, but definitive conclusions are obviously impossible in many cases.

Case Inst. of Tech., Cleveland, Ohio.
A USE OF THE ANALOG COMPUTER IN ANTENNA PATTERN STUDIES, by Forest E. Brammer and Wen-Hsiung Ko. Scientific rept. no. 6 on Contract AF 19(604)3887. [1959] 24p. 3 refs. AFCRC-TN-59-579.
Order from LC mi$2.70, ph$4.80 PB 144 010

The analog computer is shown to lend itself to an evaluation of the convolution integral that occurs in the Fourier Transform method applied to antenna pattern studies. In the integral

$$g_a(u) = \int_{-\infty}^{\infty} g(u')\, S(u-u')\, du'$$

The scanning function, S(u), is not generated in the conventional sense but is closely approximated by the series of special functions. The method is one of changing the problem from step-by-step integration to one of solving a simple set of differential equations.

Excellent agreement is found between the results of the computer method and those obtained from analytical methods.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
ON THE SYNTHESIS OF TIME VARYING LINEAR SYSTEMS, by Jose Benjar Cruz, Jr. Doctoral thesis. Technical note no. 9 on Contract AF 49(638)63. 7 Aug 59, 103p. 41 refs. AFOSR-TN-59-866; AD-226 580.
Order from LC mi$5.70, ph$16.80 PB 144 311

It is shown that any multi-input-multi-output linear system may always be represented by a set of single-input-single-output linear subsystems connected properly. Attention is focused on some properties of single-input-single-output linear systems which are generally time varying. These properties are exploited in developing synthesis procedures for time-varying linear systems with specifications in the time domain, frequency domain, and general λ domains. In connection with synthesis in a general λ domain, compatible systems are defined. The techniques for fixed linear systems in the frequency domain apply to compatible time-varying linear systems in an appropriate λ domain. The characterization or system functions for all the models considered belong to the class of separable functions first treated by Bendat. Necessary and sufficient conditions are derived for the exact realization of certain classes of functions. A much wider class of specified system functions may be expanded in terms of a set of orthogonal and realizable functions. The basic time-varying element used in most of the models is a time-varying gain amplifier. The approximation of the time-varying gain amplifier by periodically operated switches, sinusoidal time-varying amplifiers, and sequentially gated amplifiers is discussed.

Electronics Research Lab., U. of California, Berkeley.
GLOW CATHODES IN PULSED MAGNETIC FIELDS, by E. D. Hoag. Scientific rept. no. 4 on Contract AF 19(604)2270. 15 June 59, 56p. 5 refs. IER Series no. 60, issue no. 239; AFCRC-TN-59-379; AD-217 859
Order from LC mi$3.60, ph$9.30 PB 143 891

An experimental investigation has been carried out to study the microscopic characteristics of the beam in a smooth-bore cylindrical static magnetron with an aluminum secondary-emission cathode and a pulsed magnetic field. Certain curious hysteresis effects were noted that implied that the beam current depended rather sensitively upon the time derivative of the magnetic field; a discussion of the causes of this current, based on the theory of Buneman, is included. In addition, the circulating component of the beam current has been measured and is found to be compatible with the static space-charge distribution upon which Buneman bases his perturbation calculations. An Appendix has been included in which the details of the design work for the field coil and pulse facility are described in some detail.

Hermes Electronics Co., Cambridge, Mass.
THEORY OF ANTENNA PERFORMANCE IN SCATTER-TYPE RECEPTION, by S. Stein, D. E. Johansen and A. W. Starr. Final rept. on Contract AF 19(604)5214. 30 Sep 59, 179p. 26 refs. M-783; AFCRC-TR-59-191.
Order from LC mi$8.10, ph$27.30 PB 144 192

A theoretical investigation is reported which describes fundamental performance characteristics of an antenna system receiving from a distribution of coherent radio sources, such as in encountered in UHF transhorizon propagation. It is shown that to each source configuration, there exists an optimum antenna excitation which maximizes the received power. Assuming that the apparent source distribution is subject to random fluctuations in time, such as occurs in the transhorizon phenomenon, statistical properties of the received power are derived for the continuously optimized antenna. Both probability distributions and associated parameters measuring overall system performance are obtained. Computations are performed both for a small number of independently fluctuating discrete sources and for a smoothly distributed fluctuating source having small spatial correlation. As a basis for comparison, similar properties are then investigated for standard space and angle diversity systems. Initial computations indicate a large "gap" between the performance of existing or contemplated systems and the theoretical optimum.

Hughes Aircraft Co., Culver City, Calif.
A NEW METHOD OF PATTERN SYNTHESIS FOR LINEAR ARRAYS, by H. E. Shanks. Scientific rept. no. 3508/1 on Contract AF 19(604)3508. July 59, 21p. 4 refs. AFCRC-TN-59-568.
Order from LC mi$2.70, ph$4.80 PB 143 970

A unique phase expression is given which allows synthesis of a wide variety of shaped radiation patterns for a linear array. The accompanying amplitude distribution is found by a stationary phase evaluation of the radiation integral and is shown to be functionally related to the desired radiation pattern. Because of the optical type of approximation (stationary phase) used to evaluate the radiation integral, the method is most applicable to antennas with large size-to-wavelength ratios.

Institute of Mathematical Sciences, New York U., N. Y.
THE POTENTIAL AND CHARGE DISTRIBUTION NEAR THE TIP OF A FLAT ANGULAR SECTOR, by Ben Noble. Rept. on Contract AF 19(604)5238. May 59, 18p. 7 refs. Research rept. no. EM-135; AFCRC-TN-59-383; AD-226 497.
Order from LC mi$2.40, ph$3.30 PB 143 969

The calculation of the potential and charge distribution near the tip of a flat angular sector is reduced to the solution of a mixed boundary value problem on the surface of a sphere. A method is developed for finding the lowest eigenvalue and eigenfunction for this mixed problem. If r is the distance from the tip of the sector and the potential varies as r^{μ} when r tends to zero, numerical results are given for μ as a function of the angle of the sector.

Naval Ordnance Lab., White Oak, Md.
FERRITE CORE LOOP ANTENNAE PARAMETERS, by Jack Finkel. 28 July 58, 23p. 1 ref. NAVORD rept. 5764.
Order from LC mi$2.70, ph$4.80 PB 144 047

Analysis of an air-core loop, in terms of its effective height, inductance and equivalent resistance, is extended to include ferrite core antennae. An antenna whose winding is distributed over 80% of the length of the core has greater pickup than one whose winding is concentrated at the center of the core. The measurements indicate that the equivalent resistance, representing the losses in the core, is a linear function of the frequency.

Oklahoma U. Research Inst., Norman.
THEORETICAL INVESTIGATION OF THE COMPLEX INDEX OF REFRACTION OF A PLASMA FOR INFRARED AND VISIBLE RADIATION, by Otto H. Theimer. Final technical rept. on Contract DA 23-072-ORD-1320. 15 Aug 59, 28p. 15 refs. OOR rept. 2233.1-P.
Order from LC mi$2.70, ph$4.80 PB 144 330

The contributions of atoms and ions to the refractivity of plasmas are also discussed.

Stanford Electronics Labs., Stanford U., Calif.
A HOLLOW-BEAM CONDENSER, by R. E. Holaday. Rept. on Contract AF 33(600)27784. 4 June 59, 98p. 14 refs. Technical rept. no. 103-1.
Order from LC mi$5.40, ph$15.30 PB 144 060

A method is here described for condensing a hollow beam of electrons solely by means of a shaped magnetic field. If the field is shaped so that the inertial-overshoot of the electrons is not too severe, the beam follows the flux lines and shrinks in radius and thickness to a final size determined by the ratio of the final value of the magnetic field to its initial value. A theory for the electron trajectories in the absence of space charge is presented, along with the results of the theory that were obtained through use of an analog computer. Experimental results were obtained using a conventional immersed-flow hollow-beam gun placed in a shaped field generated by a series of short solenoids.

Technische Hochschule, Graz (Austria).
THEORETICAL STUDY OF TRIANGULAR APERTURE HORN ANTENNA, by Ernst Ledinegg. Final technical rept. for 1 Aug 58-31 Aug 59 on Contract DA 91-591-EUC-880. 1959, 87p. 13 refs.
Order from LC mi$4.80, ph$13.80 PB 144 376

The main part of the work was devoted to the calculation of the field types in waveguides of arbitrary cross-section. The second section of the report deals with the calculation of the radiation pattern of waveguide antennas. The third section treats the exact theory of the radiation field taking into account the interaction with the waveguide field.

Molecular Physics and Spectroscopy

Aeronutronic, Newport Beach, Calif.
EMISSIVITY OF DISPERSED CARBON PARTICLES, by V. Robert Stull and Gilbert N. Plass. Scientific rept. no. 6 on Contract AF 19(604)2166. 29 May 59, 41p. 8 refs. Publication no. U-503; AFCRC-TN-59-450.
Order from LC mi$3.30, ph$7.80 PB 144 414

The emissivity of dispersed spherical carbon particles is calculated from the Mie theory of scattering. A suitable dispersion equation is derived which represents the optical properties of carbon at flame temperatures. A general expression for the emitted radiation including all higher order scattering processes is obtained. The radiation emitted by carbon particles in flames is calculated for a range of particle radii from 50 to 800A and for several different particle size distributions. The shift of the intensity maximum to shorter wavelengths from the blackbody maximum is quantitatively explained.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ASYMMETRIC ROTOR EIGENVALUE TABLE, by T. E. Turner, B. L. Hicks, and G. Reitwiesner. Sep 53, 112p. 8 refs. Rept. no. 878.
Order from LC mi$6.00, ph$18.30 PB 144 079

A table of asymmetric rotor eigenvalues is given for $J = 1(1)12$ and $\chi = 0.00(0.01)1.00$. A brief account of the asymmetric rotor theory is also given to serve both as a ready reference for the users of this table and as a basis for the explanation of the computation. The eigenvalues were computed on the EDVAC and the methods of computation and checking are described.

Cornell U., Ithaca, N. Y.
AN OPTIMIZED METHOD FOR CORRECTING FOR SMEARING ABERRATIONS: COMPLEX X-RAY SPECTRA, by J. O. Porteus and L. G. Parratt. Technical rept. no. 7 on Contract AF 49(638)402. 1 Sep 59, 129p. 40 refs. AFOSR-TN-59-754.
Order from LC mi$6.30, ph$19.80 PB 143 952

A study is made of the true spectrum $T(\nu)$ from the observed spectrum $O(\nu_n)$ which has been recorded with a spectrometer whose smearing or "spectral window" function is $M(\nu_n - \nu)$. The correction involves the convolution or folding integral

$$O(\nu_n) = \int_{-\infty}^{\infty} T(\nu)\, M(\nu_n - \nu)\, d\nu.$$

This problem, with appropriate terminology, arises in almost every facet of experimental science. A mathematically unique solution exists only in case $O(\nu_n)$ and $M(\nu_n - \nu)$ are exactly known for all ν. Many investigators have attacked this problem, and many different "practical solutions" have been proposed. The problem is re-examined from the point of view of correcting x-ray spectra for resolving power, and previous solutions are found to be inadequate. A new

optimized solution is proposed. The errors in this solution are discussed in detail. The specific spectral examples to which the new method is applied are the K emission and absorption of crystalline potassium chloride.

Cornell U., Ithaca, N. Y.
THE TEMPERATURE DEPENDENCE OF RAMAN INTENSITIES, by G. W. Chantry. Rept. on Raman Intensities of the A_1 Lines of Oxyanions, Contract AF 49(638)279. 11 Aug 59, 11p. 12 refs. AFOSR-TN-59-743.
Order from LC mi$2.40, ph$3.30 PB 143 997

The trace of the derived polarizability tensor has been measured on an absolute scale for the ions CO_3^{--}, NO_3^-, PO_4^{-3}, SO_4^{-2} and ClO_4^- in aqueous solution. From these and the known normal coordinate matrix elements, the values of the derivative with respect to bond length have been calculated. Results are interpreted in terms of bond order, and indicate appreciable π bonding in the ions NO_3^-, SO_4^{-2} and ClO_4^- In these cases, as opposed to hydrocarbons a π electron makes a larger contribution to the derived bond polarizability than does a σ electron.

Cornell U., Ithaca, N. Y.
THE TEMPERATURE DEPENDENCE OF RAMAN INTENSITIES, by George W. Chantry and Robert A. Plane. Rept. on Raman Intensities of the A_1 Lines of Oxyanions, Contract AF 49(638)279. 11 Aug 59, 9p. 4 refs. AFOSR-TN-59-807.
Order from LC mi$1.80, ph$1.80 PB 144 013

The temperature dependence of the intensity of the Raman lines of a polyatomic molecule has been investigated. It is shown that, when account is taken of all possible "hot" band transitions as well as fundamental transitions, the temperature dependence of each band is the same as that found for the single band of a diatomic molecule. Degenerate vibrations are also considered and likewise shown to have the same temperature dependence.

Hebrew U. (Israel).
PARAMAGNETIC RESONANCE SPECTRA OF CHROMIUM AND MANGANESE IN THE SPINEL STRUCTURE, by R. Stahl-Brada and W. Low. Technical note no. 8 on Contract AF 61(052)59. June 59, 16p. 20 refs. AFOSR-TN-59-961; AD-226 397.
Order from LC mi$2.40, ph$3.30 PB 143 963

The paramagnetic resonance spectrum of Cr^{3+} was measured on a single crystal of ruby spinel $MgAl_2O_4$ at the wavelengths of 3 cms., 1.2 cm, and 8.6 mm and the paramagnetic spectrum of Mn^{2+} was measured on a single crystal of $ZnAl_2O_4$ at 3 cm.

Institute of Molecular Physics, U. of Maryland, College Park.
INVESTIGATIONS OF INTERMOLECULAR FORCES, by Edward A. Mason. Final rept. for 15 Sep 55-15 Sep 59 on Contract AF 18(600)1562. 15 Oct 59, 34p. 25 refs. AFOSR-TR-59-147.
Order from LC mi$3.00, ph$6.30 PB 144 347

A new phenomenon in gaseous diffusion has been investigated which is the analogue of the Kirkendall effect in solids. The results have been shown to be explainable on the basis of the rigorous kinetic theory of gases. The experimental method appears to be a novel and useful way of measuring gaseous diffusion coefficients. Investigations of molecule-molecule and ion-molecule forces have also been carried out theoretically through studies of scattering and mobility. Applications of the results have included determination of gaseous ion mobilities and of high-temperature gas properties.

Institute of Molecular Physics, U. of Maryland, College Park.
THE KIRKENDALL EFFECT IN GASEOUS DIFFUSION, by Kenneth P. McCarty and Edward A. Mason. Rept. on Contract AF 18(600)1562. 11 Sep 59, 96p. 28 refs. IMP-OSR-13; AFOSR-AFOSR-TN-59-966, AD-226853.
Order from LC mi$5.40, ph$15.30 PB 143 917

The different rates of transfer by random motion of the two gases in binary diffusion tend to build up a hydrostatic pressure in one region of the mixture. This pressure will cause a back flow of the two gases together. The analogous effect in solids, the Kirkendall effect, has been demonstrated experimentally for gases and the results were explained theoretically. The apparatus used to observe the Kirkendall effect in gases was essentially two bulbs connected by a capillary tube and a larger diameter tube. A drop of silicone oil blocked the larger tube. Diffusion of gases through the capillary tube built up a pressure difference that caused the drop to move. The motion of the drop was used to determine the diffusion coefficients for several gas systems after the system He-Ar had been used to calibrate the apparatus.

Kentucky U., Lexington.
SELENIDES PROJECT, by Lee Gildart and D. F. Clifton. Progress rept. no. 1 on Contract AF 49(638)90. 31 July 58, 69p. 7 refs. AFOSR-TN-58-849; AD-203 361.
Order from LC mi$3.90, ph$10.80 PB 138 436

Electrical and optical properties of vacuum-evaporated films
Reversible electrical breakdown in stibnite crystals
Liquid-solid transformations, and structure studies
Other experimental results
Work in progress

Massachusetts Inst. of Tech., Cambridge.
EFFECT OF POISONING ON THE INFRARED SPECTRUM OF CARBON MONOXIDE ADSORBED ON NICKEL, by Carl W. Garland. Technical rept. no. 2 on Contract Nonr-1841(01). 30 Jan 59, 18p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 144 145

The infrared spectrum has been determined for CO adsorbed on both freshly-reduced nickel samples and on a series of nickel samples poisoned by preadsorption of CS_2. The nickel is supported on a high-area

alumina and comprises ten percent of the sample by weight. Spectra were recorded as a function of increasing coverage as CO was adsorbed.

Materials Research Lab., Watertown Arsenal, Mass.
ON THE ROLE OF THE EQUIVALENCE RESTRICTION IN MOLECULAR CALCULATIONS, by A. J. Freeman. Aug 59, 8p. 8 refs. MRL rept. no. 66; AD-225 879.
Order from LC mi$1.80, ph$1.80 PB 144 073

The results of 2 LCAO-SCF treatments of a molecule with a degenerate open shell, OH, are reported and compared. Both procedures are variants of the equivalence and symmetry restriction techniques, as introduced by Nesbet and Roothan, for treating open shell configurations. Values of the total energy, LCAO coefficients, and dipole moment are presented. Comparison shows very good agreement between the results of the 2 calculations.

Minnesota U., Minneapolis.
INITIAL-PERMEABILITY SPECTRA OF MICROSCOPIC IRON-OXIDE PARTICLES, by W. F. Brown, Jr., J. P. Hanton, and A. H. Morrish. Rept. on Contract AF 18(603)113. Oct 59, 10p. 5 refs. AFOSR-TN-59-759.
Order from LC mi$1.80, ph$1.80 PB 143 988

The magnetic resonance of single-domain ferromagnetic particles in zero applied steady magnetic field is studied theoretically and experimentally. The axial ratio of the powder particles deduced from the resonance measurements agrees reasonably well with optical data. This is strong evidence regarding the origin of the observed resonance.

Oregon U., Eugene.
THEORY OF FINE STRUCTURE PRESSURE BROADENING OF THE VIOLET TRIPLET OF MANGANESE, by Makoto Takeo. Interim technical rept. no. 3, 1 July 58-Aug 59, on The Modification of the Shape and Positions of Spectral Lines by Foreign Gases under Well-Defined Conditions of High Pressure and High Temperature, Contract DA 04-200-ORD-713. [1959] 12p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 144 027

A theory of fine structure pressure broadening of a multiplet is applied to manganese triplet lines with and without exchange effect under LS coupling. (See also PB 142 071)

Sloane Physics Lab., Yale U., New Haven, Conn.
ZEEMAN SPLITTING OF EXCITON LINES IN CdS, by R. G. Wheeler and J. O. Dimmock. Rept. on Contract AF 49(638)503. Oct 59, 12p. 10 refs. AFOSR-TN-59-764.
Order from LC mi$2.40, ph$3.30 PB 143 957

Western Ontario U. (Canada).
SHOCK TUBE SPECTROSCOPY. I. THE SHOCK EXCITATION OF POWDERED SOLIDS by W. H. Parkinson and R. W. Nichols. Scientific rept. no. 1 on Contract AF 19(604)4560. 15 July 59, 100p. 45 refs. AFCRC-TN-59-620.
Order from LC mi$5.40, ph$15.30 PB 144 005

Helium driven shock waves in argon were used to excite a number of astrophysically important oxides (CuO, BeO, MgO, CaO, SrO, BaO, H_3BO_3, Al_2O_3, TiO_2, PbO, Pb_3O_4, V_2O_5, Cr_2O_3, $H_2W_4O_{13}$, α-Fe_2O_3, Fe_3O_4, $FeTiO_3$.) In addition to the metallic oxides some hydride compounds (Al + H, CuH) and carbon and cyanide compounds (C, AgCN, $K_3Fe(CN)_6$, $K_3Co(CN)_6$ KCN) were also studied. As an application to meteor physics four samples of meteorite were subjected to shock excitation. The type of spectrum (atomic or molecular) excited in the shock tube can be selected and restricted by suitably adjusting the Mach number (or gas temperature) through the initial pressure ratio and gas parameters. The combined results from the spectroscopic time resolved and microscopic experiments have suggested that on atomic vapour is ablated from the powder particles and excited thermally to luminosity by the argon atoms behind the reflected shock wave. This is followed by recombination of the ablated atoms to form molecules which emit the characteristic band spectrum. Finally as the temperature decreases the vapour condenses on the surfaces of the original powder grains often with the formation of new compounds.

Western Ontario U. (Canada).
SHOCK TUBE SPECTROSCOPY. II. SPECTROSCOPIC TEMPERATURE AND INTENSITY MEASUREMENTS IN A SHOCK TUBE, by W. H. Parkinson and R. W. Nicholls. Scientific rept. no. 3 on Contract AF 19(604)4560. 15 Aug 59, 45p. 26 refs. AFCRC-TN-59-622.
Order from LC mi$3.30, ph$7.80 PB 144 003

Spectroscopic rotational temperature measurements on the (0, 1) band of the CN Violet System have given temperatures which agree with the calculated gas kinetic temperature to about 10 percent. This method has provided a means of inferring a temperature without introducing temperature sensitive devices such as probes in the environment. Rotational intensity measurements on the (0, 0) AlH band of the $A^1\Pi - X^1\Sigma^+$ system has revealed an unusual intensity amomaly which is very pressure sensitive. Experiments in the shock tube at high pressure (7 to 13 atmospheres) and in a discharge tube at low pressure (less than one atmosphere) has suggested the following two possible mechanisms; (a) the presence of pressure sensitive strength factors rather than the usual H onl - London strengh factors, or (b) pressure induced predissociation of the excited $^1\Pi$ state by a postulated $^3\Sigma$ state according to the Kronig selection rules. Similar measurements with the CuH (0, 0) band ($^1\Sigma^+ - {}^1\Sigma^+$) have showed that rotational equilibrium is not obtained with this molecule.

Western Ontario U. (Canada).
TRANSITION PROBABILITIES OF MOLECULAR BAND SYSTEMS. XVI. PART I. TRANSITION INTEGRALS WITH TRANSITION MOMENTS OF EXPOTENTIAL FORM. PART II. THE RECURSION RELATION FOR GENERALIZED LAGUERRE POLY-

NOMIALS AND THE REMAINDER FORMULAE FOR OVERLAP INTEGRALS, by G. P. Henderson, W. R. Jarmain, and P. A. Fraser. Scientific rept. no. 2 on Contract AF 19(604)4560. 1 Aug 59, 27p. 19 refs. AFCRC-TN-59-621.
Order from LC mi$2.70, ph$4.80 PB 144 004

This report describes two pieces of work concerned with intensities of diatomic molecular bands. The work was carried out some years ago and now appears to be of more importance. The first part concerns the evaluation of transition integrals involving transition moments of exponential form. The second part contains general proof of results presented in previous reports which were directly calculated only for simpler, but often important, special cases. These earlier results were of such a pattern that it was possible to suggest the general form in each case. (See also PB 139 865)

Optics

Bureau of Ordnance, Dept. of the Navy, Washington, D. C.
DESIGN AND CALIBRATION OF MEDIUM AND HIGH RESOLUTION INFRARED TELESCOPES FOR OBSERVATION OF ATMOSPHERIC RADIATION. 5 Apr 57, 102p. 14 refs. NAVORD rept. 4868; AD-143 654.
Order from LC mi$5.70, ep$18.30 PB 136 474

A report is made of the instrumentation and calibration involved in studies of sky background radiation in the IR region. The region is defined as lying between approximately 0.7 and 30 μ. A detail description is given of the design and calibration of the medium resolution telescopes (for wavelength regions from 3 to 30 μ and from 0.7 to 3.0 μ) and of the high resolution telescope. Particular attention is assigned to the 1.5^{o} telescope for the thermal region designed on a modified Schwarzschild system. An inverted-cone, black-body source is compared with a Bureau of Standards calibrated lamp. The electronic components, consisting of amplifiers for the detectors and control circuits, are described. An explanation is given of the mechanical system for automatically scanning the sky.

Colorado State U., Fort Collins.
STUDIES, RESEARCH AND INVESTIGATIONS OF THE OPTICAL PROPERTIES OF THIN FILMS OF METALS, SEMI-CONDUCTORS AND DIELECTRICS, by Lawrence N. Hadley, Jr. Final rept. for 1 Feb-31 July 57 on Contract DA 44-009-eng-2618. 31 Aug 57, on Contract DA 44-009-eng-2618. 31 Aug 57, 20p.
Order from LC mi$2.40, ph$3.30 PB 144 057

Contents:
Infrared emission, Cu_2O, Sb_2O_3, Sb_2S_3, SiO_2
Experiment to detect exciton emission
Index of refraction of Cu_2O

High Altitude Observatory, Boulder, Colo.
FINAL REPORT, by Robert J. Low. Rept. on Contract AF 19(604)610. 9 July 58, 4p. 1 ref. AFCRC-TR-58-261; AD-206 784.
Order from LC mi$1.80, ph$1.80 PB 137 895

Work was summarized on the construction and assembly of the optical, mechanical, and electronic components of the 16-in. coronagraph for use at the Sacramento Peak Observatory, Sunspot, New Mexico. Other tasks were reported in mechanical and electronic construction and design, and optical construction. The initial planning and preliminary designs for an eclipse triple-spectrograph system were described.

Institute of Mathematical Sciences, New York U., N. Y.
STRUCTURE OF THE ELECTROMAGNETIC FIELD IN THE IMAGE REGION OF AN APLANATIC OPTICAL SYSTEM, by E. Wolf and B. Richards. Rept. on Contract AF 19(604)5238. July 59, 54p. 16 refs. Research rept. no. EM-136; AFCRC-TN-59-390.
Order from LC mi$3.60, ph$9.30 PB 143 890

An investigation is made of the structure of the electromagnetic field near the focus of an aplanatic system which images a point source. The solution is not restricted to systems of low aperture, and the computational results cover, in fact, selected values of the angular semi-aperture α on the image side, in the whole range $0 \leq \alpha \leq 90^{o}$. The results have an immediate bearing on the resolving power of image forming systems; they also help to understand the significance of the scalar diffraction theory, which is customarily employed without proper justification, in the analysis of images in low aperture systems.

Solid State Physics

Air Force Cambridge Research Center, Bedford, Mass.
THE STRUCTURE OF ALUMINUM OXIDE, by F. Euler. Apr 59, 46p. 16 refs. AFCRC-TR-59-141; AD-215 066.
Order from LC mi$3.30, ph$7.80 PB 144 216

After a short survey of the literature, the ionic locations in sapphire (α-Al_2O_3) are discussed. Special interest is devoted to the surroundings of the aluminum ion where six oxygen ions are nearest neighbors, three of them being closer to the aluminum ion but farther apart among themselves than the other three. Distances between nearest neighbors and angles are calculated.

Armour Research Foundation, Chicago, Ill.
EXCESS NOISE IN SEMICONDUCTORS. Rept. no. 4 (Final) for 15 Nov 56-15 Nov 57 on Contract Nonr-1800(00). 4 Dec 57, 41p. 19 refs. AD-150 614.
Order from LC mi$3.30, ph$7.80 PB 144 274

An experimental study of excess noise in semiconductors resulted in the discovery of fluctuations in the Seebeck effect, or thermoelectric potential, of semiconductors. The Seebeck noise, caused by fluctuations in the majority carrier concentration, had a 1/f component similar to that measured in current noise in semiconductors. The magnitude of the effect agreed with a straightforward calculation based on the established dependence of the thermal emf in semiconductors on carrier density when the magnitude of carrier density fluctuations was inserted. Results indicated that carrier density fluctuations with a 1/f spectrum existed even in the absence of dc current flow. Preliminary data were obtained concerning the importance of crystalline imperfections in 1/f noise. The 1/f noise level of n-type single crystal silicon decreased with increasing crystalline imperfection density.

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE MEASUREMENT OF SURFACE STRAIN BY MEANS OF BONDED BIREFRINGENT STRIPS: A PRELIMINARY REPORT, by J. Duffy and T. C. Lee. Technical rept. no. 2 on Contract DA 19-020-509-ORD-4674. June 59, 19p. 9 refs. DA-4674/2.
Order from LC mi$2.40, ph$3.30 PB 143 771

A technique for the measurement of surface strains in opaque bodies is described and applied to a study of wave propagation phenomena. Essentially the method is a variation of the birefringent coating technique. The narrow edge rather than the flat face of the plastic strip is cemented to the metal surface and viewing is parallel to this surface in a standard polariscope. In this way the birefringent strip provides a measure of the strain all the way down to the metal surface avoiding the complications due to thickness effects attendant on birefringent coatings.

California U., Los Angeles.
THE EFFECT OF THE ELASTIC INTERACTION ON THE RATE OF CLUSTER GROWTH, by W. Grupen, R. Kikuchi, and George Sines. Rept. on Contract DA 04-495-ORD-1250. Aug 59, 23p. 2 refs. Dept. of Engineering rept. no. 59-37.
Order from LC mi$2.70, ph$4.80 PB 143 834

Diffusion in a solid from a concentration gradient and an energy gradient. Discussion of the magnitude of the elastic interaction.

California U., Los Angeles.
ULTRASONIC ATTENUATION IN METALS AT LOW TEMPERATURES, by Daniel H. Filson. Technical rept. no. 13 on Contract Nonr-233(48). Jan 59, 70p. 27 refs.
Order from LC mi$3.90, ph$10.80 PB 144 140

Low temperature equipment; Acoustical measuring techniques; Techniques for resistance measurement; Low temperature measurements; Aluminum, Tin.

Cornell U., Ithaca, N. Y.
X-RAY REFLECTION STUDIES OF THE ANNEAL AND OXIDATION OF SOME THIN SOLID FILMS, by N. Wainfan and L. G. Parratt. Technical rept. no. 6 on Contract AF 49(638)402. 25 Aug 59, 29p. 23 refs. AFOSR-TN-59-755.
Order from LC mi$2.70, ph$4.80 PB 143 951

The technique of the total reflection of x-rays has been applied to the study of thin vacuum-deposited films of Cu, Ni, Ge, and Se on polished glass substrates. The effects of vacuum anneal and oxidation were studied.

Electron Tube Research Lab., U. of Minnesota, Minneapolis.
STUDIES ON BASE NICKELS FOR OXIDE COATED CATHODES, by W. G. Shepherd. Scientific rept. no. 4, 15 Jan-15 Apr 59, on Contract AF 19(604)3890. [1959] 107p. AFCRC-TN-59-399.
Order from LC mi$5.70, ph$16.80 PB 143 974

A modified circuit for use in the measurement of the saturation pulse emission of oxide-coated cathodes is described. Life tests of cathodes based on 0.22% and 0.08% Al-Ni alloy are presented. Chemical activation of an oxide cathode, under conditions allowing a controlled change in the coating reduction rate is reported. Influence of a heated Ti anode on the properties of an oxide-coated cathode is described. Poisoning of oxide cathodes due to anode bombardment is described. Particular emphasis in these studies is the recovery of emission following poisoning after various periods of cathode operation.

Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.
HIGH PRESSURE EFFECTS ON IMPURITY LEVELS IN SEMI-CONDUCTORS, by Melvin G. Holland. Technical rept. no. HP-4 on Contract Nonr-1866(10). 1 Dec 58, 146p. 84 refs.
Order from LC mi$7.20, ph$22.80 PB 143 852

Effect of high hydrostatic pressure on the impurity levels due to three different impurities in germanium and silicon. The statistics for shallow and deep-lying impurity energy levels in semiconductors are presented, and discussed in terms of an alteration of their position with pressure. Results for silicon with a hydrogen donor atom, arsenic, and two hydrogenic acceptor atoms, aluminum and indium, are discussed. Pressure decreases the ionization energy of the arsenic impurity by about 1% in 10,000 kg/cm^2. Results for both n- and p-type gold-doped germanium where the impurity energy levels are both acceptors. Effect of pressure on minority carrier trapping in p-type manganese-doped silicon.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
NATURE OF THE SINGULARITIES IN THE SPECTRUM OF A ONE-DIMENSIONAL IONIC LATTICE, by Joseph Gillis and George Weiss. Rept. on Contract AF 18(600)1315. Sep 59, 7p. 2 refs. Technical note BN-184; AFOSR-TN-59-931.
Order from LC mi$1.80, ph$1.80 PB 144 312

It is known, by a theorem of van Hove, that regular lattices will have singularities in their frequency spectra, the type of singularity depending on the dimension. Although several studies of the one dimensional lattice with coulomb interactions have appeared, no one yet has succeeded in identifying the type of singularity that appears in addition to the inverse square root singularity, in the frequency spectrum. In this note we establish that for a one-dimensional crystal the singularity is of the form $g(\omega) \sim A[(\omega - \omega_1) \ln 1/(\omega - \omega_1)]^{-1/2}$ where A is a constant and ω_1 is the position of the singularity.

Istituto Elettrotechnico Nazionale Galileo Ferraris (Italy).
OPTICAL MICROSCOPY EXAMINATION OF THE EFFECT OF HIGH ENERGY BOMBARDMENT ON SEMICONDUCTOR SINGLE CRYSTALS, by Guido Bonfiglioli, Andrea Ferro, and Adriana Mojoni. Technical note no. 1 on Contract AF 61(514)1333. [1958] 12p. 4 refs. AFOSR-TN-59-958.
Order from LC mi$2.40, ph$3.30 PB 143 962

Microscopy observations of etching patterns on Ge single crystals. The "primary structure" in etched Ge is due to the progressive rounding off of the etch pits which belonged to dislocations ending on lattice planes already taken away by the etchant.

ITT Labs., Nutley, N. J.
RESEARCH ON GROWING CRYSTALS OF FERRIMAGNETIC OXIDES, by A. J. Marino, Jr. Scientific rept. no. 8 for 1 Jan-31 Mar 59 on Contract AF 19(604)2261. July 59, 10p. 3 refs. AFCRC-TN-59-360; AD-216 817.
Order from LC mi$1.80, ph$1.80 PB 144 043

Crystals of manganese ferrite ($MnFe_2O_4$) have been grown by the flameless fusion technique with annealing during growth. A five-turn helical coil has been added to the conical r-f work coil used in this growth technique. This addition provides a method of keeping the grown crystal hot during the growth process and allows it to be cooled at a uniform rate. This slow cooling, coupled with "annealing" during growth, eliminates, or drastically cuts down, the cracking normally associated with crystals grown by flame fusion. (See also PB 140 063)

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
FIELD-STRENGTH EFFECTS IN CADMIUM SULFIDE SINGLE CRYSTALS, by H. Gildea. Rept. on Contracts Nonr-1841(01) and AT(30-1)1937. Dec 58, 18p. 8 refs, Technical rept. 133.
Order from LC mi$2.40, ph$3.30 PB 144 126

Current-voltage-time characteristics using cadmium sulfide single crystals with d-c and unidirectional pulse voltages at various temperatures. In general the crystals showed a rather high conductivity, which proved essentially independent of temperature in the range from -175° to 100°C. One type exhibited a low conductivity.

Manufacturing Labs., Inc., Cambridge, Mass.
THE LATTICE STABILITY OF METALS. II. ZINC, COPPER, AND SILVER, by Larry Kaufman. Technical rept. no. 2 on ONR Contract. 1 Jan 59, 44p. 28 refs.
Order from LC mi$3.30, ph$7.80 PB 144 220

An integrated thermodynamic analysis of the f. c. c.(α) and b. c. c. (β) solid solutions of the Ag-Zn and Cu-Zn systems. The differences in free energy between the α, β, and η (h. c. p.) forms of zinc, and the α and β forms of copper and silver have been calculated as a function of temperature. It is possible to calculate the activity of zinc in the α and β phases of Cu-Zn and Ag-Zn over a wide range of temperature and composition.

Materials Research Lab., Watertown Arsenal, Mass.
LONG-RANGE MAGNETIC INTERACTIONS VIA CONDUCTION ELECTRONS, by Arthur Paskin. July 59, 10p. 9 refs. MRL Rept. no. 65; AD-225 568.
Order from LC mi$1.80, ph$1.80 PB 144 072

Yosida [Phys Rev. 106:893, 1957] has shown that the long-range Zener ferromagnetic term [Phys. Rev. 81:440, 1951] arising from the exchange interaction between conduction electrons and unfilled-inner-shell electrons, does not appear explicitly when the calculation is extended to second-order perturbation. The magnetic interaction term to second-order perturbation, decreases rapidly with distance and is short-range relative to the Zener interaction which extends uniformly throughout the solid. Re-examination of the Yosida calculation discloses that the long-range magnetic term disappears because of certain free-electron approximations made for the energy and density of states of the conduction electrons. In a more general formulation of these terms, the Zener interaction does appear with a coefficient proportional to the difference of the density of states and the second-derivative of the number of electrons (of a given spin) with respect to their energy. Using nuclear magnetic resonance data, an estimation is made that the magnitude of the Zener term and the short-range interaction term are the same for the Cu-Mn alloys studied by Yosida.

Miami U., Coral Gables, Fla.
EFFECTIVE MASS OF ELECTRONS IN GALLIUM ARSENIDE, by L. C. Barcus, A. Perlmutter and J. Callaway. Rept. on Contract AF 49(638)62. 5 Mar 58, 9p. 6 refs. AFOSR-TN-58-152; AD-152 178.
Order from LC mi$1.80, ph$1.80 PB 137 659

The effective mass of electrons in a sample of n type gallium arsenide has been measured by determining the reflectivity in the infrared. The value obtained, $0.043 \pm 0.005\ m_o$, supports the hypothesis that the minimum of the conduction band is at the center of the Brillouin Zone.

Michigan U. [Research Inst.] Ann Arbor.
THE USE OF ELECTROLUMINESCENT PHOSPHORS IN THERMAL IMAGING, by Paul A. Silberg. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Oct 57, 16p. 11 refs. 2144-120-T.
Order from LC mi$2.40, ph$3.30 PB 144 129

This report describes two possible ways of using electroluminescent phosphors for thermal imaging. The phosphors may be (1) mixed with a temperature-sensitive dielectric; or (2) deposited as a film on a temperature-sensitive dielectric. A theoretical analysis of each method is provided including an estimate of their respective sensitivities $\left(\frac{1}{B}\frac{dB}{dT}\right)$

Minerals Research Lab., U. of California, Berkeley.
EFFECT OF DILUTE COPPER ALLOYING ON THE ACTIVATION ENERGIES FOR CREEP OF ALUMINUM SINGLE CRYSTALS, by D. Walton, L. Shepard, and J. E. Dorn. Technical rept. no. 7 on Contract Nonr-222(49). 1 Dec 58, 33p. 15 refs. Series no. 103, issue no. 7.
Order from LC mi$3.00, ph$6.30 PB 144 118

The activation energies for creep of single crystals of Al containing up to 0.25% Cu in Alpha solid solution were determined by the effect of small changes in temperature on the creep rate. From 490°K to about 700°K, alpha solid solution alloys of Al containing 0.09% to 0.25% Cu yielded an activation energy of 41,000 cal/mole.

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
MICROWAVE CRYSTAL DETERIORATION STUDIES, by P. P. Lombardini. Quarterly progress rept. no. 2, 1 Nov 58-31 Jan 59, on Study of the Deterioration of Microwave Crystal Diodes Exposed to High Level R-F Energy, Contract DA 36-039-sc-78055. 28 Feb 59, 32p. 3 refs. Moore School rept. no. 59-10.
Order from LC mi$3.00, ph$6.30 PB 144 155

During recent experimental investigations, it has been found that the process of temporary deterioration can be effected by the application of short duration d-c pulses to the diode in the negative direction. The effects of d-c and r-f pulses have been compared. The dependence of the phenomena of temporary deterioration upon r-f pulsewidth has been studied for the case of a carrier frequency in the S-band. Limited measurements have been made of the dependence of d-c backward current change on increasing temperature of the diode. These measurements indicate a continuous increase in backward current and a decrease in the percent change of backward current for temperatures above 100°C. (See also PB 142 764)

Naval Ordnance Lab., White Oak, Md.
A NEUTRON DIFFRACTION STUDY OF CHROMIUM-SUBSTITUTED FERRITES, by Stanley J. Pickart. 7 June 58, 83p. 28 refs. NAVORD rept. 6101.
Order from LC mi$4.80, ph$13.80 PB 144 048

The temperature dependence of the individual sublattice magnetizations, as well as the effect of an applied field upon the coherent magnetic intensities, has been determined for several of the compositions studied. The subject of this report is a study of the magnetic and crystallographic properties of mixed ferrite-chromites.

Naval Ordnance Test Station, China Lake, Calif.
SEMINAR ON SOLID-STATE PHYSICS, by R. S. Witte, C. E. Mandeville and others. 24 June 58, 54p. 6 refs. NOTS 2023.
Order from LC mi$3.60, ph$9.30 PB 144 049

Five selected subjects presented at the Seminar are: (1) Statistical Mechanics for Solids; (2) F-Centers and Luminescence; (3) Neutron Diffraction; (4) Electron Resonance in Solids; and (5) Polarons.

Pennsylvania U., Philadelphia.
THE INFLUENCE OF RADIATION INDUCED AND OTHER IMPERFECTIONS ON THE MECHANICAL, THERMAL AND OPTICAL PROPERTIES OF ALKALI HALIDE CRYSTALS by B. R. Russell, P. H. Miller, Jr. and M. E. Caspari. Final rept. on Contract AF 18(600)561. July 59, 58p. 15 refs. AFOSR-TR-59-123.
Order from LC mi$3.60, ph$9.30 PB 144 350

The research can be divided into two separate but somewhat related problems. One of these is concerned with the difference between the thermal expansion of alkali halide crystals when the expansion is measured by macroscopic techniques and when it is measured by determining changes in the lattice constant as a function of temperature by x-ray techniques. The other part of the program was concerned with a study of radiation damage from weak ionizing irradiation in alkali halides, and in particular KCl and NaCl crystals.

Polytechnic Inst. of Brooklyn, N. Y.
COMPOUNDS WITH DEFECT LATTICES, by E. Banks. Progress rept. no. 3, 1 Dec 56-28 Feb 57, on Contract DA 36-039-sc-71242. 29 Mar 57, 64p. 20 refs. AD-132 031.
Order from LC mi$3.90, ph$10.80 . PB 138 208

An analysis of the magnetic effects of substitution in single crystals of $BaM_xFe_{(12-x)}O_{19}$ (where M = Al or Ga) suggests that Al enters preferentially in octahedral sites, while Ga shows preference for tetrahedral sites at low concentrations, but substitutes randomly at higher concentrations. Some preparations with zinc and magnesium partially substituted for iron were strongly magnetic. Some progress has been made in the direction of preparation of copper-iron selenides. A study of color centers produced by X-irradiation of CdF_2, containing NaF and/or CeF_3 in solid solution, is reported. (See also PB 138 209)

Polytechnic Inst. of Brooklyn, N. Y.
COMPOUNDS WITH DEFECT LATTICES, by E. Banks. Progress rept. no. 4, 1 Mar-31 May 57, on

Contract DA 36-039-sc-71242. 25 June 57, 22p. 2 refs. AD-140 664.
Order from LC mi$2.70, ph$4.80 PB 138 207

Some preparations in the Cu-Fe-Se system have been made at integral ratios of known selenides. $CuFe_2Se_{2.5}$ yielded a weakly magnetic material with an X-ray pattern different from those previously reported. Cu_2FeSe_2 preparation showed some lines of the $CuFeSe_2$-$CuFe_2Se_3$ phase plus many additional lines. On heating WO_3 in vacuo with Ta_2O_5, new tetragonal phases were formed, having patterns similar to those of tetragonal $Na_{0.28}WO_3$. The samples had lost oxygen on heating, and were colored blue to green. A crystal-pulling apparatus was constructed, and some details of its operation are given. (See also PB 138 208)

Raytheon Mfg. Co., Waltham, Mass.
STUDY OF SEMICONDUCTOR MATERIALS AND DEVICES. Final rept. for 1 Oct 55-30 June 57 on Contract NObsr-72537; [Continuation of Contract NObsr-57323. [1957] 95p. 16 refs. AD-141 843.
Order from LC mi$5.40, ph$15.30 PB 137 774

The annealing behavior was studied in crystals which were grown from quartz crucibles and in samples where dislocations were introduced by plastic bending. For a deformed sample with a dislocation density of 10^7/sq cm, the amplitude of the 9-mμ band was reduced appreciably in 15 min at 1000°C; the undeformed sample with a dislocation density of 10^4/sq cm requires about 12 hr. Preliminary light scattering experiments in deformed and annealed samples show a definite anisotropy of the scattered intensity when the light vector is perpendicular or parallel to the dislocation lines. Measurements of surface conductance on germanium and silicon indicated localized surface states at the semiconductor-semiconductor oxide interface. Changes in structure were observed following the application of high electric fields across the oxide film. Control of the diffusion process for device fabrication was improved to yield reproducible values of Co and penetrations of about 4×10^{17}/cc and 0.5 mil, respectively. A new type HF semiconductor amplifying device, the spacistor, is described which utilizes the high field of a reverse biased junction to produce a very short transit time for the injected carriers. The device appeared operable at microwave frequencies.

Rice Inst., Houston, Tex.
ELECTRON EMISSION FROM PLASTICALLY STRAINED ALUMINUM, by W. D. Von Voss and F. R. Brotzen. Technical rept. no. 1 on Contract Nonr-2116(02). 31 Dec 58, 34p. 16 refs. AD-218 857.
Order from LC mi$3.00, ph$6.30 PB 143 929

Aluminum was strained in tension under a Geiger-Müller counter. Both the electron emission associated with plastic deformation and the subsequent delayed emission were observed. An attempt was made to correlate quantitatively the emission rates with the mechanical variables, i.e., strain and rate of deformation. The model used for this correlation links point imperfections formed during deformation with the emission from the oxide surface film.

Stanford Electronics Labs., Stanford U., Calif.
SPIN-LATTICE RELAXATION VIA HARMONIC COUPLING, by W. S. C. Chang. Rept. on Contract AF 33(600)27/84. 27 Aug 57, 18p. 8 refs. Technical rept. no. 156-5; AD-226 020.
Order from LC mi$2.40, ph$3.30 PB 144 062

Substantial experimental evidence was found for a new mechanism of spin-lattice relaxation which is called harmonic cross-relaxation. The relaxation rate of one transition in a multi-level system (ruby in the present instance) is found to be drastically shortened when the frequency of another transition is twice or 3 times the frequency of the first transition. The effect is observed with a traveling-wave-maser apparatus to permit wideband measurements. In one method, the inversion ratio of a 3-level maser pumping on transition 2-4 and amplifying on 2-3 is found to become unusually high when the idle or 3-4 frequency is one third of the 1-3 frequency, and to be small when this is not the case. The idle transition is apparently shorted out by harmonic coupling. In another method, which does not involve any maser action, the recovery of a saturated transition is observed directly at various operating points including ones where harmonic coupling to a transition at twice the frequency is present. With a short saturating pulse, 2 (or more) relaxation times are observed. The results indicate that if harmonic coupling is present, the 2 transitions thermalize with each other at a rapid rate (≈10 msec) and then both together thermalize with the lattice at a slower rate (≈100 msec). A saturating pulse longer than 10 msec brings both transitions to the same temperature and only the long relaxation time is observed.

Westinghouse Research Labs., Pittsburgh, Pa.
PARAMAGNETIC RELAXATION STUDIES IN MASER CRYSTALS, by J. G. Castle, Jr. P. F. Chester, and P. E. Wagner. Quarterly rept. no. 1 on Contract AF 19(604)5589. 8 July 59, 21p. 7 refs. Research rept. 403FD449-R3; AFCRC-TN-59-396.
Order from LC mi$2.70, ph$4.80 PB 144 188

Conclusions are stated concerning spin relaxation effects in dilute potassium chromicyanide.

Yale, U., New Haven, Conn.
LATTICE IMPERFECTIONS IN METALLIC AND IONIC CRYSTALS; AND THE OPTICAL ABSORPTION EDGE OF INSULATING CRYSTALS AT LOW TEMPERATURES, by Arthur S. Nowick and Robert G. Wheeler. Rept. for 1 July 53-28 Feb 59 on Contract AF 18(600)850. 10 Sep 59, 13p. 8 refs. AFOSR-TR-59-142.
Order from LC mi$2.40, ph$3.30 PB 143 955

Experiments on electrical properties, optical properties, internal friction, and elastic modulus of alkali halide and gold crystals.

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
TRANSPORT PROPERTY EQUATIONS FOR PARTIALLY IONIZED GASES, by C. W. Baulknight. Rept. on Contract AF 04(647)269. 18 Sep 59, 15p. 15 refs. Technical Information Series R59SD428.
Order from LC mi$2.40, ph$3.30 PB 144 132

Two types of systems are considered in this theoretical investigation. Type I is a system of charged-charged particles and the Coulombic interaction potential is assumed. In type II, the system is composed of both charged and uncharged particle, i.e. $N^+ + N$, and $\frac{1}{\gamma_4}$ potential is assumed. The $\frac{1}{\gamma_4}$ term is corrected for the polarizabilities. Some typical results are presented for the Diffusion. Viscosity and Thermal Conductivity coefficients for the Charged - change system in the temperature range of 10,000 to 15,000°K.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
INTERACTION OF ELECTROMAGNETIC WAVES WITH IONIZED GASES, by Robert G. Jahn. Technical rept. no. 9 on Contract AF 18(603)02. Aug 59, 54p. 5 refs. AFOSR-TN-59-911; AD-226 365.
Order from LC mi$3.60, ph$9.30 PB 144 321

Possibilities are explored with regard to the use of microwaves as probes to study ionized gas flows. The case is studied where the propagating waves are disturbed by the gas, rather than the gas being disturbed by the wave field. The distinction is mainly implicit in the strength of the impressed signal, and, to a certain extent, in the free charge and total particle densities. Waves of small amplitude are considered; therefore, no component of the gas other than the electrons, both free and bound, is significantly disturbed. As such, the treatment is relevant to such problems as the study of the characteristics of ionized gases by microwave probes, and the problems of electromagnetic communication into and through ionized gas layers. Throughout, the approach is one which starts from the basic field relations and at every opportunity takes the simplest alternatives consistent with physical experience, while attempting to demonstrate the salient features of the interaction with a minimum of mathematical encumbrance.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
THE PAIR DISTRIBUTION FUNCTION OF A HARD SPHERE BOSE SYSTEM CALCULATED BY THE PSEUDO-POTENTIAL METHOD, by Leopoldo S. Colin. Rept. on Contract AF 18(600)1315. Sep 59, 39p. 7 refs. Technical note BN-185; AFOSR-TN-59-928.
Order from LC mi$3.00, ph$6.30 PB 144 293

The pair distribution function for a system of hard sphere bosons has been performed replacing the hard sphere potential by the so-called pseudo-potential. The problem has been carried through using the quasi-particle formalism of Bogoliubov. In this calculation one considers a system of bosons interacting via the pseudo-potential, which can be regarded as a weak interaction when the system is very dilute. The Hamiltonian of the system is diagonalized by means of a canonical transformation and this has the effect of separating the energy into two parts, one which is the ground state energy and the other one which corresponds to an ideal Bose gas composed of "elementary excitations" or quasi-particles. This formalism was applied to the calculation of the pair distribution function of our system. This quantity was calculated by averaging over a grand canonical ensemble constructed with the total number of quasi-particles. A result which is seen to be valid both for the condensed and gaseous phases of the system and also for any distance r between the particles has been obtained. (See also PB 142 990)

Microwave Lab., Stanford U., Calif.
ACTION-TRANSFER AND FREQUENCY-SHIFT RELATIONS IN THE NONLINEAR THEORY OF WAVES AND OSCILLATIONS, by P. A. Sturrock. Technical note on Contract AF 49(638)415. Sep 59, 21p. 13 refs. M. L. rept. no. 625; AFCRC-TN-59-892.
Order from LC mi$2.70, ph$4.80 PB 144 380

Certain relations which have arisen in the theories of electrical networks, electron tubes, plasma oscillations and particle accelerators are here shown to be special cases of general relations attributable to any system which may be described by a Hamiltonian. If such a system is analyzed into an interacting set of modes (waves or oscillators), we find that the rates of transfer of action to or from members of a group of interacting modes are in integral ratios, the integers being determined by the interaction, and are related in magnitude to the energy associated with the interaction. We find furthermore a conjugate set of relations which lead to the following statement: the fractional shifts in frequency of members of a group of interacting modes, when multiplied by the energies in those modes, are in integral ratios, the integers being determined by the interaction, and are related in magnitude to the energy associated with the interaction.

Microwave Lab., Stanford U., Calif.
THE EXCITATION OF PLASMA OSCILLATIONS, by P. A. Sturrock. Technical note on Contract AF 49(638)415. Sep 59, 15p. 12 refs. M. L. rept. no. 610; AFCRC-TN-59-891.
Order from LC mi$2.40, ph$3.30 PB 143 994

The theory of Bohm and Gross and the experiments of Looney and Brown upon the excitation of plasma oscillations by the two-stream mechanism, which appear superficially to be in disagreement, are here shown to be compatible with each other and with related experiments.

Stanford Electronics Labs., Stanford U., Calif.
THE BENNETT PINCH, by O. Buneman. Rept. on Contract AF 19(604)1847. 17 June 59, 33p. 13 refs.

Technical rept. no. 104-2; AFCRC-TN-59-555.
Order from LC mi$3.00, ph$6.30 PB 143 972

A fully covariant description of the Bennett Pinch is given, valid even for relativistic temperatures, and a rigorous procedure for testing its stability with respect to all kinds of perturbation is outlined.

University Coll. of North Staffordshire (Gt. Brit).
QUANTUM MECHANICS OF ATOMS, MOLECULES AND CRYSTALS. Annual technical rept. ATR no. 1, 1 Oct 58-30 Sep 59, on Molecular Quantum Theory, Contract DA 91-508-EUC-390. 30 Oct 59, 41p. 24 refs.
Order from LC mi$3.30, ph$7.80 PB 144 469

Progress has been made in the following fields: The Water Molecule. The Graphite Layer. Many-Electron Quantum Mechanics (General Theory). Automatic Computation. Three- and Four- Electron Systems.

Thermodynamics

Armour Research Foundation, Chicago, Ill.
THE MECHANICAL PROTECTION OF THE W/Ir THERMOCOUPLE, by Gary Steven and Walter C. Troy. Rept. no. 22, 5 Sep-7 Oct 49. 13 Oct 49. 7p. NEPA 1185-ARM-23; AD-206 716.
Order from LC mi$1.80, ph$1.80 PB 138 452

Two zirconia tube shielded W/Ir thermocouples and an Ir/60% Rh, 40% Ir thermocouple were tested at 2000°C in oxidizing surroundings. The W/Ir thermocouples were operated in neutral atmospheres. Both ceramic tubes failed during the heating period of the furnace. A recalibration of the Ir/60% Rh, 40% Ir thermocouple after a 17-hour campaign at high temperature showed only a slight loss in thermal emf output. Furthermore, the weight loss at 2000°C in moderately oxidizing atmosphere was of a magnitude that would permit 100 hours of service at temperature. Safety equipment was added to the furnace set-up. Alimina and beryllia protected W/Ir thermocouples are now ready for high temperature stability tests. (See also PB 138 456)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
CONDUCTION OF HEAT IN ONE-DIMENSIONAL MANIFOLDS WITH ARBITRARY INTERNAL HEAT SOURCES, by John F. Detlef. May 56, 19p. 2 refs. Rept. no. 980.
Order from LC mi$2.40, ph$3.30 PB 144 083

The general problem of heat conduction in one-dimensional manifolds composed of two substances of different conductivities and with arbitrary internal heat sources is here formulated and a general formal solution to the problem is obtained by operator methods. Of the several special cases discussed the most general is that of internal sources of exponential type. An existence theorem for one aspect of the general problem is included.

Brown U. Div. of Applied Mathematics, Providence, R. I.
TRANSIENT THERMAL STRESSES IN A SEMI-INFINITE SLAB, by Walter Jaunzemis (Pennsylvania State U.) and Eli Sternberg. Technical rept. no. 5 on Contract Nonr-562(25). Jan 59, 43p. 9 refs. 562(25)/5.
Order from LC mi$3.30, ph$7.80 PB 144 404

This investigation is concerned with the transient temperature and thermal-stress distribution generated in a semi-infinite slab if a finite segment of its edge is subjected to a sudden uniform change in temperature. The slab is supposed to be free from external loads and its faces are assumed to be insulated. Exact solutions in series form are obtained both for the heat-conduction problem and for the associated thermoelastic problem. The latter is treated quasi-statically within the classical two-dimensional theory of elasticity. The thermal stresses appropriate to the generalized plane-stress solution vanish identically in the limit as time tends to infinity. (See also PB 140 512)

Columbia U., New York.
TRANSPORT PROPERTIES OF GASES AT HIGH TEMPERATURES, by Charles F. Bonilla. Final rept. on Contract Nonr-266(11). 10 Feb 58, 2p. CU-20-58-Nonr-266(11)-Ch. E; AD-153 026.
Order from LC mi$1.80, ph$1.80 PB 138 328

The following technical activities were completed: (1) a mathematical analysis of the temperature fluctuations of a hot-wire surrounded by a gas and heated with alternating current superimposed on direct current, including amplitude and phase lag of the temperature wave behind the power wave, as a function of the thermal diffusivity of the surrounding gas; (2) construction and testing of a tungsten hot-wire cell, and the circuitry required to carry out the determination experimentally; (3) the viscosities of argon, steam, and heavy-water vapor were measured in a capillary efflux viscometer at atmospheric pressure up to 1600°C; and (4) the viscosities of steam-nitrogen mixtures were measured in a modified capillary efflux viscometer at atmospheric pressure from 350° to 860°C.

Illinois U. Engineering Experiment Station, Urbana.
EFFECT OF HEAT TRANSFER ON FLOW FIELD AT LOW REYNOLDS NUMBERS IN VERTICAL TUBES, by Edward M. Rosen and Thomas J. Hanratty. Technical rept. no. 8 on Contract DA 11-022-ORD-1707. Oct 59, 248p. 61 refs.
Order from LC mi$11.10, ph$41.10 PB 144 030

Variation of density and viscosity with temperature may cause distortions in the flow field and affect the rate of heat transfer to fluids flowing in vertical tubes. Under relatively mold conditions of heating and cooling with a constant temperature wall these distortions may be large enough to change the parabolic velocity profile associated with isothermal flow to such an extent that the flow becomes unstable and breaks down into turbulence. For heating in upflow it was found experimentally that unstable flows exist when the center line velocity drops to zero (inversion point) and

may even exist under milder conditions. For cooling in upflow unstable flows appeared to arise under only slightly more severe conditions than are necessary to cause the velocity gradient at the wall to go to zero. (See also PB 142 059)

Institute of Flight Structures, Columbia U., New York.
HEAT CONDITION IN A MELTING SLAB, by Stephen J. Citron. Technical rept. no. 15 on Contract Nonr-266(20). Jan 59, 96p. 28 refs. CU-15-59-ONR266(20)-CE.
Order from LC mi$5.40, ph$15.30 PB 144 260

The behavior, after the initiation of melting, of a slab insulated on one side and subjected to a heat input varying arbitrarily with time on the other is studied. A method of successive approximations is developed which requires the solution of an ordinary non-linear differential equation. Curves of melt-thickness versus time are presented for a constant heat input and for a typical heat input incurred by a body descending through the atmosphere.

Mellon Inst., [of Industrial Research] Pittsburgh, Pa.
ON THE THERMOSTATICS OF CONTINUOUS MEDIA, by Bernard D. Coleman and Walter Noll (Carnegie Inst. of Tech.). Rept. on Contract AF 49(638)541 and NSF-G 5250. July 59, 77p. 15 refs. AFOSR-TN-59-852; AD-225 435.
Order from LC mi$4.50, ph$12.30 PB 144 320

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Michigan U. Research Inst., Ann Arbor.
AN EXPERIMENTAL INVESTIGATION OF THE POSSIBILITY OF ACHIEVING A STANDING DETONATION WAVE, by J. A. Nicholls, E. K. Debora, and R. S. B. Ong. Final rept. 2284-23-F; AFOSR-TR-59-132; AD-226 658.
Order from LC mi$2.70, ph$4.80 PB 143 908

The properties of gaseous detonation waves and the conditions that must be met to generate stable waves are described and discussed, as is the experimental facility which evolved as a result of these considerations. Preliminary experiments leading to the first known case of a stabilized detonation wave (probably very close to the Chapman-Jouguet case) are also described. In these experiments an ignition time delay has been detected between the shock wave and onset of combustion. It appears that this experimental technique has great potential in the study of chemical kinetics as well as in the study of stabilized detonation waves. Preliminary analytical work on the stability of a plane detonation wave is discussed.

Midwest Applied Science Corp., Lafayette, Ind.
PERIODIC TEMPERATURE DISTRIBUTION IN LAMINATED SOLIDS, by Richard J. Grosh. Rept. on Research on Application of the Theory-Practice of Electric Circuits to the Study of Transients in Thermal Insulation, Contract AF 33(616)5623. July 59, 29p. 37 refs. WADC Technical note 59-185.
Order from OTS $0.75 PB 161 292

Periodic heat conduction in plane, cylindrical, and spherically laminated solids is considered. Attention is given to cases of isotropic laminates, with constant product of density and specific heat and space varying thermal conductivity, after the transient period state has disappeared. Special attention is paid to treating these problems by matrix methods as suggested by the analogy of this problem with electrical four terminal networks. Finally, these mathematical methods are used to study the distributed parameter approximation of a plane laminated solid and in this way give some indication of the differences between steady state and transient measurements of thermal properties for porous insulating materials. The results indicate that, to a first approximation, a definite difference exists. The magnitude of the difference depends on the difference in thermal properties for the matrix and interstice material and the type transient. Nusselt's idealization of porous thermal insulation, a parallel fissured body, was used throughout the calculations.

Naval Ordnance Lab., White Oak, Md.
A METHOD FOR THE RAPID NUMERICAL SOLUTION OF THE HEAT CONDUCTION EQUATION FOR COMPOSITE SLABS, by Julius W. Enig. 20 Aug 59, 22p. 2 refs. NAVORD rept. 6666.
Order from LC mi$2.70, ph$4.80 PB 144 193

Two boundary conditions encountered in the heating of one-dimensional double slabs are the following: the heat flux is given at the inner surface and (a) the heat flux or (b) the temperature is prescribed at the outer surface. In this paper, a method is developed which permits the rapid calculation of (1) any given interior point temperature, and (2) the outer surface temperature or flux for (a) or (b) respectively, without computing other interior point temperatures. The partial differential equations are integrated in terms of an arbitrary outer surface temperature, the solution joined to the remaining boundary condition, and the resulting integral equation evaluated for the outer surface temperature or flux by a simple numerical scheme. The method performs an exact integration over the space dimension. Hence, once the outer surface temperature is determined, the interior temperatures are computed by exact formulae. Numerical solutions are compared to an exact solution for accuracy and to other numerical schemes for speed.

Naval Ordnance Test Station, China Lake, Calif.
DESIGN AND USE OF FINE WIRE THERMOCOUPLES FOR RESEARCH, by Maynard H. Hunt. Sep 59, 37p. 17 refs. NOTS TP 1919; NAVORD rept. 5828.
Order from LC mi$3.00, ph$6.30 PB 144 481

The work of several investigators in the field of heat transfer to fine wires in air is summarized, and empirical relationships established. The construction of fine thermocouples is described, with emphasis on the practical aspects of the problem, and several specialized probes are described.

Wave Propagation

[American Radio Relay League, West Hartford, Conn.]
A STUDY OF TRANSEQUATORIAL SCATTER PROPAGATION. Final rept. on Contract AF 19(604)2171. [1959] 27p. 5 refs. AFCRC-TR-59-262.
Order from LC mi$2.70, ph$4.80 PB 144 235

The ARRL-IGY Propagation Research Project was organized to collect and utilize observations by amateur radio operators in the very high frequency range. Bands available to them are one or more of the following (depending on location): 50-54, 70-72, 144-148, 220-225 and 420-450 Mc. The large number of such stations and their considerable activity more than offset the inability to make precise quantitative measurements. The well-known enthusiasm of the "hams" insured full cooperation from a network of observers not economically possible to duplicate in any other manner.

Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INPUT IMPEDANCE OF A BEAM COUPLED TO A PLATE, by George L. Lamb, Jr. Rept. on Contract Nonr-2322(00). 19 Dec 58, 31p. Rept. no. 603.
Order from LC mi$3.00, ph$6.30 PB 143 979

The present report analyzes the motion of an infinite elastic beam attached to an infinite elastic plate, and excited by a localized harmonic force. The interesting physical features of the bar-plate problem are illustrated in a simplified manner by considering first an infinite string attached to an infinite membrane. The results for the beam-plate system may be expressed in terms of two parameters, k_bL and r. The parameter k_bL describes the frequency dependence and degree of coupling of the beam to the plate, increasing with increasing frequency and with decreasing degree of coupling. At very low forcing frequencies, the plate stiffness combines with the bar mass to reduce the input impedance of the coupled system. At higher frequencies the impedance is essentially that of an uncoupled bar. The parameter r is the ratio of wavelength on the plate to wavelength on the bar.

Brown U. Div. of Engineering, Providence, R. I.
A LINE SOURCE ON AN INTERFACE BETWEEN TWO MEDIA, by V. M. Papadopoulos. Scientific rept. no. 5 on Research Directed Toward the Study of Radiation of Electromagnetic Waves, Contracts AF 19(604)4561 and Nonr-562(24). July 59, 16p. 8 refs. AF-4561/5; AFCRC-TN-59-564.
Order from LC mi$2.40, ph$3.30 PB 144 011

The velocity and pressure field of an unsteady line source is calculated by a similarity method when its strength is taken to have a step-function time dependence. The acoustic approximation is used in the case when the source lies on the stationary plane interface between homogeneous fluids of different density; the velocity of sound in each fluid is also different. The time derivative of the solution in section 1 of this acoustic problem gives the velocity potential when an acoustic line pulse occurs in the surface of, say, a deep sea. This is a first order solution in which the interaction of the acoustic disturbance above and below the interface is examined. The solution in section 1 is also of direct application in electromagnetic theory. This is discussed in section 3.

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
THE NATURE OF FADING PATTERNS OF OBLIQUE INCIDENCE RADIO SIGNALS RECEIVED AT MIDDLE LATITUDES DURING CERTAIN IONOSPHERIC DISTURBANCES, by Peter Ford Nicholson. Technical rept. no. 47 on Studies on Propagation in the Atmosphere, Contract DA 36-039-sc-74903. 18 Aug 58, 92p. 24 refs. Research rept. EE 372.
Order from LC mi$5.40, ph$15.30 PB 144 175

The fading of tone modulated CW transmissions from Ottawa, Canada, and Washington, D. C., have been recorded for a period of approximately two years. A close inspection of these records has been executed with the particular intention of arriving at some explanation for the fast-flutter fading observed during disturbed periods. It was found that on a qualitative, as well as on a statistical basis, the fading of the received signal varied with both type and intensity of disturbance. In the presence of an aurorally disturbed ionosphere, the character of fading was described as peaky random. Fading during spread F is again of the fast-flutter type. If sporadic E is the predominating disturbance, an important feature of the fading is the presence of large variations in signal strength. Distortion of voice modulated signals in the high frequency band may be described qualitatively as ranging from a slight tremolo during a mild disturbance to almost complete unreadability for severe conditions. In the present experiment if was found that distortion increased with both the amplitude of components in the fading spectrum and the extent to which higher components were present. The relationship between fading rate and transmission frequency has been investigated, and the results given. A relatively simple derivation for the frequency independence of the forward scattering is found in Appendix II.

Electrical Engineering Research Lab., U. of Texas, Austin.
REFLECTION OF CENTIMETER AND MILLIMETER RADIO WAVES FROM THE SURFACE OF A SMALL LAKE, by A. W. Straiton, J. R. Gerhardt and others. Rept. on Contract Nonr-375(01).

15 May 52, 26p. 5 refs. Rept. no. 63; ATI-194 010.
Order from LC mi$2.70, ph$4.80 PB 144 370

Reflection from the surface of a small lake was measured at wavelengths of 9, 3.2 and 0.86 centimeters with wind speeds over the lake ranging from four to twenty miles per hour. The path length used was 1430 feet and grazing angles up to 3 degrees were reached. Both horizontal and vertical polarizations were used. The nine and three centimeter fields at a given height fluctuated less than one decibel with time and their height-gain curves were easily identified with those predicted by the interference of a direct and a surface reflected wave. The characteristics of the eight and six tenths millimeter waves varied considerably with the degree of surface roughness. On the calmest day, the time variation of the signal at a maximum on the height-gain run was less than one decibel. The same variation increased to one and one-half decibels when the wind speed was thirteen miles per hour and to ten decibels when the wind was twenty miles per hour. The reflection coefficient curves for the various wavelengths and wind conditions are shown in the report.

Electrical Engineering Research Lab., U. of Texas, Austin.
STUDIES OF 2.15mm PROPAGATION AT AN ELEVATION OF 4 Kms AND THE MILLIMETER ABSORPTION SPECTRUM, by C. W. Tolbert, A. W. Straiton, and J. H. Douglas. Rept. on Contracts Nonr-375(01) and Nonr-375(07). 1 Nov 58, 18p. 6 refs. Rept. no. 104.
Order from LC mi$2.40, ph$3.30 PB 144 074

The water vapor losses at a wavelength of 2.15 millimeters were found to be 0.12 db/km/gram/m^3 at an elevation of 4 kilometers. Oxygen losses at the 4 km elevation were unmeasureably small and the scintillation of the signal over a 1.73 km path was less than 0.2 decibel. A calculated water vapor and oxygen absorption spectrum of the millimeter wavelengths, using the Van Vleck-Weisskopf equation and line breadth constants of 0.27 cm^{-1} and 0.02 cm^{-1}, respectively, was found to fit the measured values of absorption at wavelengths of 8.6, 4.3, 3.35 and 2.15 mm much better than do the normally accepted line breadths of 0.1 cm^{-1} for water vapor and 0.02 cm^{-1} for oxygen.

Institute of Mathematical Sciences, New York U., N. Y.
FIELDS IN THE NEIGHBORHOOD OF A CAUSTIC, by Irvin Kay. Rept. on Contract AF 19(604)3495. Sep 59, 23p. 4 refs. Research rept. no. EM-138; AFCRC-TN-59-567.
Order from LC mi$2.70, ph$4.80 PB 143 971

Starting with Picht's solution of the wave equation in the form of an integral of plane waves over a caustic we derive expressions for the solution which depend entirely on the geometry of the problem. An asymptotic evaluation of Picht's integral for high frequencies gives the desired result which can have a number of different forms depending on the precise region where the field is being observed. In particular, a change in the asymptotic field occurs in going from the regular ray field to the caustic or from a regular part of the caustic to a cusp.

Michigan U. Research Inst., Ann Arbor.
A THEORETICAL METHOD FOR THE CALCULATION OF THE RADAR CROSS SECTIONS OF AIRCRAFT AND MISSILES, by J. W. Crispin, Jr., R. F. Goodrich, and K. M. Siegel. Rept. on Contract AF 19(604)1949. July 59, 414p. 143 refs. 2591-1-H; AFCRC-TN-59-774.
Order from LC mi$11.10, ph$63.60 PB 144 373

The problem of characterizing the radar properties of complex targets is such as to forbid a precise delineation of the methods. That this obtains will be made clear below as we point out the methods by means of examples. We will find that, although the formal solutions are known, the application of them to a given radar target usually leads to such complicated and involved treatments as to render these formal solutions practically useless. What is necessary is to first approximate the complex target by a collection of simple shapes, to next find appropriate methods of characterizing the radar properties of the simple shapes, and finally to recombine the simple shapes along with their radar characteristics to give a useful radar description of the original complex target.

Raytheon Mfg. Co., Wayland, Mass.
IONOSPHERE PROPAGATION STUDIES, by Leonard C. Edwards and D. E. Lindsay. Scientific rept. no. 2-7, 15 Sep 58-15 Mar 59, on Contract AF 19(604)2246. 15 Apr 59, 36p. 2 refs. AFCRC-TN-59-559.
Order from LC mi$3.00, ph$6.30 PB 144 379

The material in this report comprises the start of the third consecutive year of measurements over this HF forward scatter link. The results of the measurements indicate very little change in the signal levels for corresponding periods during the three years. During the early part of this period, changes were being incorporated into the Grand Bahama Island station and recording of the Greencastle signal there was not possible. Some measurements were made during February and March, but the signal to noise ratio was very poor. There is some indication, as there was in the case of 29 mc operation, that the signal level on 22 mc is about 10 db higher than expected. Confirmation of this would be dependent on a better knowledge of the gain realizable for the antennas being used for the two links being compared.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Applied Mathematics and Statistics Lab., Stanford U., Calif.
A MEASURE OF THE EFFORT REQUIRED TO INCREASE RELIABILITY, by Arthur Albert. Technical rept. no. 43 on Contract N6onr-251(40). 5 Nov 58, 15p.
Order from LC mi$2.40, ph$3.30 PB 144 317

In this case, failures in the system occur because so many components are involved. The results are there-

fore not necessarily applicable to the case where the system is unreliable because a few constituent components are highly unreliable. A compromise method would consist of estimating the reliability of sub-systems. In order to arrive at a good experimental design, some method for judging the effort involved in improving the reliability of a sub-system should be defined. For the sake of a preliminary study, we shall consider the simplest possible system, the so-called series system.

Naval Research Advisory Committee, Department of the Navy, Washington, D. C.
BASIC RESEARCH IN THE NAVY. A REPORT TO THE SECRETARY OF THE NAVY, by Arthur D. Little, Inc. Rept. on Contract Nonr-2516(00). 1 June 59, 2 vols. 57 refs.
Order from OTS $7.00(2 vols.) PB 151 925

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New York U., N. Y.
A STUDY OF CYRILLIC PRINTING TYPES IN RUSSIAN TECHNICAL LITERATURE, WITH SPECIAL REFERENCE TO THEIR APPLICABILITY TO SYSTEMS OF AUTOMATIC PRINT READING, by Charles Boni. Rept. on Russian Type Study, Contract AF 30(602)1824. 28 Apr 59, 190p. RADC-TR-59-35; AD-211 938.
Order from LC mi$8.40, ph$28.80 PB 143 945

An investigation of Russian type styles was conducted on recent and current printing of Russian technical literature to gather data of potential significance in the design of a character-discriminating device for scanning that literature. The following subject areas were selected for investigation and study: (1) physical characteristics of Russian publications, with special reference to papers and inks; (2) formal characteristics of the Cyrillic types used in current Russian publications, including a comparison with Latin alphabet characters; (3) light-reflectance properties of pages of Russian publications according to the imprint patterns left by the inked type on the paper; (4) typographic characteristics of Russian technical printing; (5) Russian proofreading, with special reference to typographic errors and such linguistic errors as misspellings and transpositions; and (6) trends and developments in print of Russian Technical publications.

Office of Ordnance Research, Durham, N. C.
PROCEEDINGS OF THE CONFERENCE [NO. 4] ON THE DESIGN OF EXPERIMENTS IN ARMY RESEARCH, DEVELOPMENT, AND TESTING SPONSORED BY THE ARMY MATHEMATICS STEERING COMMITTEE CONDUCTED AT THE QUARTERMASTER RESEARCH AND ENGINEERING CENTER 22-24 OCTOBER, 1958. Aug 59, 241p. 36 refs. Rept. no. 59-2.
Order from LC mi$11.10, ph$37.80 PB 143 833

Contents:
Errors of the third kind in statistical consulting
The AASHO road test as an example of large scale tests
Multiple correlation of mechanical with ballistic properties of armor plate
Analysis of cathode interface resistance equipment
Experimental designs for bio-assay with Pathogens
The application of experimental designs to radar systems data
Effects of ballistic and meteorological variations on the accuracy of artillery fire
Characteristics of various methods for collecting sensitivity data
Establishing and testing criteria for trajectory smoothing
Evaluation by indirect means of effects of bacteria on an unchallenged host
Determination of performance criteria for Quartermaster corps functions
Program for the interlaboratory determination of compression set of elastomers at low temperatures
An appraisal of sequential analysis under conditions restricted by the requirements for advanced scheduling and programming
Simplified computational procedures for estimating parameters of a normal distribution from restricted samples
Statistical problems associated with missile testing
Application of sequential type design and analysis to field tests
A discourse on a sequential observational program used in a study of a response surface for a complex weapons system
Some statistical aspects of preference and related tests
Statistical methods applied to the textile industry

Syracuse U. Research Inst., N. Y.
MULTIDIMENSIONAL INFORMATION THEORY, by Walter R. Baum and Stanford Goldman. Annual rept. no. 1 through 1 July 58 on Contract Nonr-669(10). Dec 58, 11p. 1 ref. Rept. no. EE494-5812A.
Order from LC mi$2.40, ph$3.30 PB 144 288

The principal purpose of the investigation is to develop an information theory which actually elucidates and makes full use of the multidimensional aspects of multidimensional information. A further purpose of the investigation is to exploit methods or results developed in the course of the work by application to other sciences. The general plan of attack has been along two different lines, both of which are continuing. The first line of attack has been along the line of pure mathematics. This work has included a study of the properties of functionals of multidimensional figures and a generalization of Crofton's ideas of geometric probability. It has also included the application of various advanced mathematical methods to the problem of finding a suitable measure theory for multidimensional figures. The second line of attack has been a study of the use of information in biological systems with the expectation that this will throw light on the salient characteristics of information and its use.

SOCIAL SCIENCES

Stanford U., Calif.
ON THE STABILITY OF DYNAMIC PROCESSES, by Hirofumi Uzawa. Technical rept. no. 61 on Contract N6onr-21533. 28 Nov 58, 16p. 7 refs.
Order from LC mi$2.40, ph$3.30 PB 144 165

In economic analysis the question is raised whether or not the values of the prices or quantities changing subject to economic laws approach equilibrium values. With respect to the price mechanism of the competitive market, the stability problem has been extensively investigated and the price mechanism formulated as a system of differential equations. In the theory of optimum resource allocation, various dynamic processes which represent the competitive price mechanism are also formulated as systems of differential equations and it is questioned whether or not the optimum activity levels are stable. In the present note a system of differential equations is considered which represents a general dynamic process, and gives a sufficient condition for the stability of the system.

Wisconsin U., Madison.
HIGH LATITUDE FRONTIER SETTLEMENT, by Kirk H. Stone. Annual rept. on Contract [Nonr-1202(05)]. 1 Dec 58, 14p. U. of Wis. no. 484:2439.
Order from LC mi$2.40, ph$3.30 PB 143 859

The chief objective is to determine the planning procedures which will insure the maximum degree of permanence of present and future frontier settlement in the North American Subarctic and Arctic. This research is limited to people of races which are primarily mid-latitude inhabitants and does not include more than general consideration of native high latitude groups like the Eskimo, Indian, and Same (Lapp). In order to accomplish the chief objective it is essential to determine methods by which the permanence of frontier settlement may be measured. A secondary objective is to establish what the basic characteristics are of all high latitude frontier settlement by non-indigenous races in order to classify such settlement for analysis regarding social, economic, and military significance. Another secondary objective is to train Scandinavian and American graduate geographers in frontier settlement research so as to accelerate such study as well as to promote closer professional and personal relations between the countries involved.

Documentation

Armed Services Technical Information Agency, Arlington, Va.
AUTOMATION OF ASTIA: A PRELIMINARY REPORT, by William A. Barden, William Hammond, and J. Heston Heald. Dec 59, 55p. AD-227 000.
Order from OTS $1.25 PB 161 306

Early considerations in automation: The history of ASTIA's experience in planning and implementing the automation of its functions is presented. Different ideas were examined and discarded in a search for a more efficient method of indexing and retrieving information. In 1953 a preliminary study based on a systems concept embracing all the functions and services of the Agency was conducted, but a full scale study was not possible until 1958. When the final selection of the Remington Rand USS-90 (Univac Solid State Computer) was made, the ASTIA staff devised methods for making optimum use of the equipment in both the business-type and information retrieval functions. Automation program: The pre-automation and automated processing of reports through ASTIA and validation of requests of military contractors is described. The three stages by which the automatic data processing system will be put into operation are examined, and the process of compiling mechanized cumulative indexes to the Technical Abstract Bulletin is presented. Creation of a Thesaurus of Scientific Descriptors: The main objectives of Project MARS (Machine Retrieval System) are: (1) to prepare a Thesaurus of descriptors; and (2) to assign these descriptors to all AD numbered reports in the ASTIA collection. The ASTIA subject headings and subdivisions were overhauled and the list reduced from 70,000 to about 7,000 headings, now termed descriptors. The scope of subject coverage was divided into about 290 generic categories called display schedules. Procedures were established for the assignment of retrieval terms, both standard descriptors from the Thesaurus and "open-ended terms" which will not appear in the Thesaurus but will provide additional retrieval access points in the form of project names, equipment nomenclature, trade names, etc.

Case Inst. of Tech., Cleveland, Ohio.
AN OPERATIONS RESEARCH STUDY OF THE DISSEMINATION OF SCIENTIFIC INFORMATION, by Michael H. Halbert and Russell L. Ackoff. 14 Feb 58, 62p.
Order from LC mi$3.90, ep$12.30 PB 144 328

Columbia U. Bureau of Applied Social Research, N. Y.
THE FLOW OF INFORMATION AMONG SCIENTISTS; PROBLEMS, OPPORTUNITIES, AND RESEARCH QUESTIONS, by Charles Y. Glock, Herbert Menzel and others. May 58, 208p. 3 refs.
Order from LC mi$9.30, ph$31.80 PB 144 390

David Taylor Model Basin, Washington, D. C.
STANDARDIZATION REQUIREMENTS FOR TECHNICAL REPORTS, by Robert E. Lord. Rev. ed. Feb 59, 42p. Rept. 1010.
Order from LC mi$3.30, ph$7.80 PB 144 372

This report presents the technical report standards established by the Bureau of Ships for its various laboratories and defines the different kinds of BuShips reports. It also outlines the procedures to be followed by the David Taylor Model Basin in the preparation and publication of technical reports consistent with BuShips policy.

Rutgers State U., New Brunswick, N. J.
PILOT STUDY ON THE USE OF SCIENTIFIC LITERATURE BY SCIENTISTS, by Ralph R. Shaw. Rept. on National Science Foundation Grant G-536. 21 Nov 56, 104p. 33 refs.
Order from LC mi$5.70, ep$18.30 PB 144 327

ATOMIC ENERGY COMMISSION REPORTS

Reports may be purchased in accordance with instructions on the inside front cover of the U. S. GOVERNMENT RESEARCH REPORTS. As PB numbers are not indicated, order by series and number These reports may also be consulted at any AEC Depository Library. A list of these libraries may be obtained from the U. S. Department of Commerce. Office of Technical Services, Washington 25, D. C.

Reproduction in whole or part of any report listed herein is encouraged by the U. S. Atomic Energy Commission, subject to the approval of authors or originating sites. General inquiries from the industrial press about AEC-developed information should be directed to the Industrial Information Branch, Atomic Energy Commission, Washington 25, D C..

Biology and Medicine

The toxicity of indium, by W. L. Downs, J. K. Scott, L. T. Steadman, and E. A. Maynard. The University of Rochester. Atomic Energy Project. Radiation Chemistry and Toxicology Division, Rochester, N. Y. Nov 59. Contract W-7401-eng-49. 57p. Order from OTS. $1.75. UR-558

Studies on the toxicity of thorium nitrate, by W. L. Downs, J. K. Scott, E. A. Maynard, and H. C. Hodge. The University of Rochester. Atomic Energy Project, Radiation Chemistry and Toxicology Division, Rochester, N. Y. Dec 59. Contract W-7401-eng-49. 35p. Order from OTS. $1.00. UR-561

The phospholipide and phospholipide-fatty-acid composition of human serum lipoprotein factors, by G. J. Nelson and H. K. Freeman. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Oct 59. Contract W-7405-eng-48. 23p. Order from OTS. 75 cents. UCRL-8930

Chemistry—General

Thermochemical studies of organic fluorine compounds. Final report. Univ. of Colorado. Boulder, Colo. (nd). Contract AT(11-1)-168. 72p. Order from LC. Mi $4.50, ph $12.30. AECU-4201

The aqueous solubility of UF_4, by A. W. Savage, Jr., and J. C. Browne. Los Alamos Scientific Lab., Los Alamos, N. Mex. [1958?]. Contract W-7405-eng-36. 9p. Order from LC. Mi $1.80, ph $1.80. AECU-4244

Correlation of polarographic data with structure. Use of the Hammett-Taft relation. Report no. 48, by P. J. Elving and J. M. Markowitz. Univ. of Michigan, Ann Arbor, Mich. Sep 58. Contract AT(11-1)-70. 12p. Order from LC. Mi $2.40, ph $3.30. AECU-4254

Determination of hydrogen in solid hydride compounds by use of induction heating, by R. A. Dunleavy, M. R. Menke, and E. W. Rebol. General Electric, Atomic Products Div., Aircraft Nuclear Propulsion Dept., Cincinnati, Ohio. Jan 56. Contracts AT(11-1)-171 and AF 33(600)-38062. 7p. Order from OTS. 50 cents. APEX-243

Methods for the study of gas-metal reactions in ultra-high vacuum, by G. R. Love. Oak Ridge National Laboratory, Oak Ridge, Tenn. June 59. Contract W-7405-eng-26. 33p. Order from LC. Mi $3.00, ph $6.30. CF-58-9-93

Spectrographic analysis of normal human tissue from Richmond, Virginia, by I. H. Tipton, M. J. Cook, J. M. Foland, J. Rittner M. Hardwick, and K. K. McDaniel. Oak Ridge National Laboratory, Oak Ridge, Tenn. Aug 59. 52p. Order from LC. Mi $3.60, ph $9.30. CF-59-8-106

Equilibrium calculation in the system: Uranyl nitrate, nitric acid, water, TBP, and kerosene diluent using the oracle digital computer, by S. H. Jury and M. E. Whatley. Oak Ridge National Laboratory, Oak Ridge, Tenn. Aug 59. Contract W-7405-eng-26. 28p. Order from LC. Mi $2.70, ph $4.80. CF-59-8-122

An automatic water deaeration system, by J. R. Raymond. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. Apr 59. Contract W-31-109-Eng-52. 7p. Order from LC. Mi $1.80, ph $1.80. HW-60058

Sequential separation of some actinide elements by anion exchange, by F. P. Roberts and F. P. Brauer. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. June 59. Contract W-31-109-Eng-52. 9p. Order from LC. Mi $1.80, ph $1.80. HW-60552

A remote phase separation bulb for highly radioactive sample analyses, by M. H. Campbell. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. July 59. 12p. Order from LC. Mi $2.40, ph $3.30. HW-61179

Reliability of mass spectrometric determination of boron isotope abundance, by W. O. Haas, Jr., F. M. Rourke, J. L. Mewherter, and P. H. McDonald. General Electric Co., Knolls Atomic Power Lab., Schenectady, N. Y. Oct 59. Contract W-31-109-Eng-52. 19p. Order from OTS. 75 cents. KAPL-2062

The density of liquid plutonium metal, by C. E. Olsen, T. A. Sandenaw, and C. C. Herrick. The University of California. Los Alamos Scientific Lab., Los Alamos, N. Mex. Dec 59. Contract W-7405-ENG-36. 14p. Order from OTS. 75 cents. LA-2358

Uses of depleted uranium, by J. E. Donahue and A. E. Higinbotham. Massachusetts Institute of Technology. Engineering Practice School, Oak Ridge, Tenn. Nov 59. Contract W-7405-eng-26. Subcontract 70. 32p. Order from OTS. $1.00. MIT-OR-5

Effect of a thermal gradient on the hydrogen distribution in a metal. Application to the sodium reactor experiment, by G. G. Libowitz. Atomics International. A Division of North American Aviation, Inc. Canoga Park, Calif. Dec 59. Contract AT(11-1)-GEN-8. 20p. Order from OTS. 75 cents. NAA-SR-4194

Semiannual progress report for the period January 1959 through June 1959, by C. J. Rodden and others. New Brunswick Laboratory, New Brunswick, N. J. Oct 59. 63p. Order from OTS. $1.75. NBL-156

Particle size reduction during ultrasonic precipitation of thorium oxalate, by J. L. Straughn and W. B. Tarpley. Aeroprojects, Inc., West Chester, Pa. June 59. Contract AT(30-1)-1836. 51p. Order from LC. Mi $3.60, ph $9.30. NYO-7935

Measurement of radiative lifetimes. I. An apparatus for measurement of millimicrosecond radiative lifetimes of gas-phase molecules. II. The radiative lifetime of the $B\,O_u^+$ state of I_2 by two absolute absorption methods. Thesis, by F. E. Stafford. Appendix: Description of electronic system, by J. M. Sakai and F. E. Stafford. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Sep 59. Contract W-7405-eng-48. 128p. Order from OTS. $2.75. UCRL-8854

Charged-particle-induced fission: A mass spectrometric yield study. Thesis, by Y. Y. Chu. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Nov 59. Contract W-7405-eng-48. 75p. Order from OTS. $2.00. UCRL-8926

Bio-organic chemistry quarterly report for June, July, August 1959. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Sep 59. Contract W-7405-eng-48. 58p. Order from OTS. $1.50. UCRL-8961

Chemistry—Radiation and Radiochemistry

Concentration and final purification of neptunium by anion exchange, by J. L. Ryan. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Sep 59. Contract AT(45-1)-1350. 18p. Order from OTS. 75 cents. HW-59193 REV

Radioisotopes in industry. Report by National Industrial Conference Board, Inc. (nd). Con-AT(30-1)-2135. 136p. Order from OTS. $2.75. NYO-2977

Chemistry—Separation Processes for Plutonium and Uranium

Total cross sections of tritium hydrogen, and helium for fast neutrons, by J. H. Coon, R. O. Bondelid, and D. D. Phillips. Los Alamos Scientific Lab., Los Alamos, N. Mex. Oct 52. Decl. with deletions May 12, 1955. Contract W-7405-eng-36. 12p. Order from LC. Mi $2.40, ph $3.30. AECD-4284

Activation analysis of trace cobalt in tissue using 10.5-minute cobalt-60m, by D. G. Kaiser and W. W. Meinke. Univ. of Michigan. Ann Arbor, Mich. 1959. 13p. Order from LC. Mi $2.40, ph $3.30. AECU-4289

A study of equilibria involved between Darex off-gases and solutions. Annual report no. 1 for December 1, 1958 through July 31, 1959, by C. Orr, Jr., M. C. Kordecki, J. K. Gladden, and C. T. Young. Georgia Institute of Technology. Engineering Experiment Station, Atlanta, Ga. 1959. Contract W-7405-eng-26. 39p. Order from LC. Mi $3.00, ph $6.30. AECU-4304

A study of equilibria involved between Darex off-gases and solutions. A literature survey on the solubility of argon, chlorine, hydrogen chloride, nitric oxide, nitrogen, nitrogen dioxide, nitrous oxide and oxygen in water, nitric acid, hydrochloric acid and aqua regia. Special report no. 1, by T. W. Wilson. Georgia Institute of Technology. Engineering Experiment Station, Atlanta, Ga. June 59. Contract W-7405-eng-26. 107p. Order from LC. Mi $5.70, ph $16.80. AECU-4319

Solids accumulation and fission heating in the HRT Chemical Plant underflow pot (Co-op report, fall quarter, 1958), by W. E. Dunn. Oak Ridge National Laboratory, Oak Ridge, Tenn. June 59. Contract W-7405-eng-26. 14p. Order from LC. Mi $2.40, ph $3.30. CF-59-6-121

Decontamination of the PRFR Pilot Leaching Plant--Preliminary process design, by H. A. McLain. Oak Ridge National Laboratory, Oak Ridge, Tenn. July 59. Contract W-7405-eng-26. 9p. Order from LC. Mi $1.80, ph $1.80. CF-59-7-75

Reprocessing of ARE fuel, volatility Pilot Plant runs E-3 through E-6, by C. L. Whitmarsh. Oak Ridge National Laboratory, Oak Ridge, Tenn. Aug 59. 39p. Order from LC. Mi $3.00, ph $6.30. CF-59-8-73

Additional information on Eurochemic air sampling system, by E. M. Shank. Oak Ridge National Laboratory, Oak Ridge, Tenn. Sep 59. 2p. Order from LC. Mi $1.80, ph $1.80. CF-59-9-44

Estimate of potential fuel reprocessing, revision no. 29--Part A, by J. W. Ullmann. Oak Ridge National Laboratory, Oak Ridge, Tenn. Sep 59. 9p. Order from LC. Mi $1.80, ph $1.80. CF-59-9-51

Dissolution of thorium in mixtures of HNO_3 and HF, by D. G. Karraker and others. E. I. du Pont de Nemours & Co. Explosives Dept. Atomic Energy Div., Technical Div., Savannah River Lab., Aiken, S. C. Sep 59. Contract AT(07-2)-1. 16p. Order from OTS. 50 cents. DP-399

Reprocessing of power reactor fuels. Eighth quarterly progress report, July 1, 1959 to October 1, 1959, by E. S. Occhipinti and others. E. I. du Pont de Nemours & Co. Explosives Div., Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. Nov 59. Contract AT(07-2)-1. 11p. Order from OTS. 50 cents. DP-439

Chemical stability of purex and uranium recovery process solvent, by R. H. Moore. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Mar 55. Decl. July 15, 1959. Contract W-31-109-Eng-52. 15p. Order from LC. Mi $2.40, ph $3.30. HW-34501

The removal of iodine from dissolver off-gas by caustic scrubbing, by K. V. Seyfrit. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. May 57. Decl. with deletions July 7, 1959. Contract W-31-109-Eng-52. 6p. Order from LC. Mi $1.80, ph $1.80. HW-50259(Del.)

Pretreatment of fuel elements. Technical report no. 48: Chapter 130, by E. Detrilleux. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. [1958]. 10p. Order from LC. Mi $1.80, ph $1.80. NP-7754

Basic Chemistry. Technical report no. 38. Chapter 120, by S. Ahrland. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. 1959. 33p. Order from LC. Mi $3.00, ph $6.30. NP-7775

Introduction. Summary of work and plans. Report ED-I, Chapter 100, by E. Haeffner. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. 1959. 30p. Order from LC. Mi $3.00, ph $6.30. NP-7781

Activity Balance. Technical report no. 51, Chapter 160, by E. Detilleux, A. Redon, and M. Zifferero. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. [nd]. 9p. Order from LC. Mi $1.80, ph $1.80 NP-7783

Eurochemic purex flowsheets: No. 1. Drawing 89a and No. 2. Drawings 89b and 90b. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. 1959. Order from LC. Mi $3.30, ph $7.80. NP-7827

Safety hazards considerations. Technical report no. 45, Chapter 500, by H. H. Ph. Moeken and J. J. H. Alderhout. European Company for the

Chemical Processing of Irradiated Fuels, Mol, Belgium. 22p. Order from LC. Mi $2.70, ph $4.80. NP-7834

The site: Preliminary report on soil and underground water investigation. Technical report 44, Chapter 300, by E. Lüscher. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. [1959]. 22p. Order from LC. Mi $2.70, ph $4.80. NP-7846

Preliminary cost estimates. Technical report no. 47, Chapter 600, O. Jenne, E. Lüscher, M. Lung, F. Marcus, and A Redon. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. [195?] 5p. Order from LC. Mi $1.80, ph $1.80. NP-7853

Instrumentation: Principles, Specifications, flow sheets, data sheets, electrical equipment. Technical report no. 53. Chapter 220, by R. Winckler. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. 1959. 35p. Order from LC. Mi $3.60, ph $9.30. NP-7862

Chemical process flowsheets. Technical report no. 49, Chapter 140, by E. Detilleux, M. Lang, E. L. Nicholson, and A. Redon. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. [1959]. 55p. Order from LC. Mi $4.40, ph $12.30. NP-7866

Layout principles of main plant building. Technical report no. 46, Chapter 400, by E. Lüscher. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. [1959]. 3p. Order from LC. Mi $1.80, ph $1.80. NP-7867

Routine analytical laboratory requirements. Technical report no. 36, Chapter 410, by K. Samsahl and W. Schüller. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. [1959]. 11p. Order from LC. Mi $2.40, ph $3.30. NP-7868

Site development. Building arrangements. Technical report no. 43, Chapter 310, by E. Lüscher. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. [1959]. 4p. Order from LC. Mi $1.80, ph $1.80. NP-7869

Drawing standards for equipment and instrument flowsheets. Technical report no. 39, Chapter 200, by O. Jenne and R. Winckler. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. [ndl. 13p. Order from LC. Mi $2.40, ph $3.30. NP-7870

Fuel element investigation compilation of data. Report ED-C Rev., Chapter 110. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. 1959. 24p. Order from LC. Mi $2.70, ph $4.80. NP-7872

Chemical engineering. Technical report no. 41, Chapter 210. Appendix includes 37 drawings. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. 1959. 10p. Order from LC. Mi $11.10, ph $93.60. NP-7881

Sulfex process: Depassivation of stainless steel, by T. A. Gens. Oak Ridge National Laboratory, Chemical Technology Div., Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 13p. Order from OTS. 50 cents. ORNL-2785

Controlled Thermonuclear Processes

Little pig plasma experiment. University of California. Radiation Laboratory, Livermore, Calif. Oct 58. 6p. Order from LC. Mi $1.80, ph $1.80. AECU-4309

Controlled Thermonuclear Research quarterly report, March, April, May 1959. University of California. Lawrence Radiation Laboratory, Berkeley and Livermore, Calif. June 59. Contract W-7405-eng-48. 102p. Order from OTS. $2.50. UCRL-8775

Criticality Studies

Multiplication measurements with highly enriched uranium metal slabs, by J. T. Mihalczo and J. J. Lynn. Oak Ridge National Laboratory, Oak Ridge, Tenn. July 59. Contract W-7405-eng-26. 35p. Order from LC. Mi $3.00, ph $6.30. CF-59-7-87

Isolation thicknesses of water for UO_2F_2 solution systems, by C. L. Schuske and A. N. Nickel. The Dow Chemical Company. Rocky Flats Plant, Denver, Colo. Dec 59. Contract AT(29-1)-1106. 11p. Order from OTS. 50 cents. RFP-169

SS Materials Management Meeting, May 25-28, 1959. United States Atomic Energy Commission, Nuclear Materials Management Div., Oak Ridge, Tenn. Nov 59. 227p. Order from OTS. $2.25. TID-7581

Health and Safety

Proceedings of the Second Industrial Medical Conference, Carbide and Carbon Chemicals Corporation, held at K-25 Plant Dispensary, Oak Ridge, Tennessee, August 18-20, 1948. Carbide and Carbon Chemicals Corp., K-25 Plant, Oak Ridge, Tenn. 119p. Order from LC. Mi $6.30, ph $19.80. AECU-4277

Special report on operation of KIWI-A reactor. Period covered: May, June, July, 1959, by O. R. Placak. Atomic Energy Commission. Nevada Test Organization, Off-site Radiological Safety Activities. July 59. 34p. Order from LC. Mi $3.00, ph $6.30. AECU-4294

The scattering of thermal radiation into open underground shelters, by T. P. Davis, N. D. Miller, T. S. Ely, J. A. Basso, and H. E. Pearse. University of Rochester, Atomic Energy Project, Rochester, New York. Oct. 59. 23p. Order from OTS. 75 cents. CEX-58.2

High-altitude sampling techniques. Progress report. University of Chicago, Chicago Midway Labs., Chicago, Ill. July 59. Contract AT(11-1)-508. 9p. Order from LC. Mi $1.80, ph $1.80. CML-SR-M-124-7

A proposed nuclear safety indicator for contact maintenance purposes, by G. M. Muller and N. Ketzlach. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Oct 55. Decl. Apr. 2, 1959. 3p. Order from LC. Mi $1.80, ph $1.80. HW-39433

A personnel film badge neutron dosimeter, by F. Swanberg, Jr. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. May 59. Contract W-31-109-Eng-52. 16p. Order from LC. Mi $2.40, ph $3.30. HW-56827 (Rev.)

Health physics semiannual report for January-June 1959, by W. H. Truran. Knolls Atomic Power Lab., Schenectady, N. Y. 1959. Contract W-21-109-Eng-52. 20p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-HP-1

Problems of air-borne contamination in handling PuF_4 powders, by W. R. Kennedy, A. Dumrose, and A. Ludwig. Los Alamos Scientific Lab., Los Alamos, N. Mex. July 47. Decl. Apr. 27, 1959. 18p. Order from LC. Mi $2.40, ph $3.30. LAMS-596

Soil sampling program for determining world-wide distribution of strontium 90. Summary of remarks to be made by L. T. Alexander to the Conference on the Passage of Fission Products through Food Chains at Harwell, England. Department of Agriculture. Soil Survey Labs., Beltsville, Md. Sep 58. 13p. Order from LC. Mi $2.40, ph $3.30. M-7089

Analysis of stratospheric strontium-90 measurements, by L. Machta and R. J. List. Weather Bureau, Washington, D. C. Mar 59. 22p. Order from LC. Mi $2.70, ph $4.80. M-7090

Field trial of treatments affecting strontium uptake. Department of Agriculture. 1954. 8p. Order from LC. Mi $1.80, ph $1.80. M-7123

High-level spill at the Hilac, by N. B. Garden and C. Dailey. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Sep 59. Contract W-7405-eng-48. 40p. Order from OTS. $1.25. UCRL-8919

Radioactivity of thorium and feasibility of in vivo thorium measurements, by R. E. Cofield. Union Carbide Nuclear Co. Division of Union Carbide Corp., Y-12 Plant, Oak Ridge, Tenn. Nov 59. Contract W-7405-eng-26. 25p. Order from OTS. $1.00. Y-1280

Instruments

Medium low-level soft-beta counting equipment, by J. E. Lewis. Radiochemistry, Inc., Louisville, Ky. June 59. Contract AT(11-1)-530. 35p. Order from LC. Mi $3.00, ph $6.30. AECU-4232

Upper atmosphere monitoring program. Report no. 1907. Progress report no. 7. Covering period February 1, 1959 through April 30, 1959, by J. Baumstark, S. Jones, R. Olson, A. Schekman, S. Stern, L. Torgeson, and W. Zeller. General Mills, Inc., Minneapolis. July 59. Contract AT(11-1)-401. 74p. Order from LC. Mi $3.90, ph $10.80. AECU-4280

Centrifuge for radiochemical processing. Little (Arthur D.) Inc., Cambridge, Mass. Sep 55. Contract W-7405-eng-26. 35p. Order from LC. Mi $3.00, ph $6.30. ALI-C-59535

An improved nuclear density gauge. Period covered June 1 to July 1, 1959, by G. M. Burgwald and

C. A. Stone. Illinois Institute of Technology. Armour Research Foundation, Chicago, Ill. June 59. Contract AT(11-1)-745. 4p. Order from LC. Mi $1.80, ph $1.80. ARF-1152-1

An improved nuclear density gauge. Period covered July 1 to August 1, 1959, by G. M. Burgweld. Illinois Institute of Technology. Armour Research Foundation, Chicago, Ill. Aug 59. Contract AT(11-1)-745. 4p. Order from LC. Mi $1.80, ph $1.80. ARF-1152-2

The effect of freon-114 on space recorders, by W. E. Hensel, Jr. Goodyear Atomic Corp., Portsmouth, Ohio. Apr 58. Decl. with deletions July 23, 1959. Contract AT(33-2)-1. 14p. Order from LC. Mi $2.40, ph $3.30. GAT-232(Del.)

Ring gasket punch guide, by K. B. Booth. Goodyear Atomic Corp., Portsmouth, Ohio. Dec 57. Contract AT(33-2)-1. 2p. Order from LC. Mi $1.80, ph $1.80. GAT-L-431

Factors affecting power transformer failure. A bibliography, by R. D. Hamilton. Goodyear Atomic Corp., Portsmouth, Ohio. Sep 59. Contract AT(33-2)-1. 25p. Order from LC. Mi $2.70, ph $4.80. GAT-T-574

Critical incident alarm--Model I: Instruction and maintenance manual, by P. R. Kelly. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. May 59. 14p. Order from LC. Mi $2.40, ph $3.30. HW-60320

Conversion of mica-window G-M tube lead-pig counters to scintillation detection, by W. G. Spear and G. D. Crouch. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. May 59. 8p. Order from LC. Mi $1.80, ph $1.80. HW-60338

An eddy current channel spacing gage, by A. C. Lind. Knolls Atomic Power Lab., Schenectady, N. Y. June 59. Contract W-31-109-Eng-52. 37p. Order from LC. Mi $3.00, ph $6.30. KAPL-M-ACL-1

Elements of fuel contamination control by alpha counting, by P. L. Eisenacher. Knolls Atomic Power Lab., Schenectady, N. Y. Aug 59. Contract W-31-109-Eng-52. 15p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-PLE-2

A graphite-CO_2 ionization chamber instrument for gamma ray dose rate measurements with a six decade range, fast response and remote recording, by F.C.V. Worman and P. S. Harris. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Dec 59. Contract W-7405-ENG-36. 18p. Order from OTS. 75 cents. LA-2361

A coil type level gauge for high temperature liquid metals, by G. E. Turner. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 25p. Order from OTS. 75 cents. NAA-SR-4195

Improved alpha spectroscopy using a modified frisch grid ionization chamber and a 256-channel analyzer, by T. B. Crockett, T. T. McMillan, and J. W. Crowe. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Jan 60. Contract AT(11-1)-GEN-8. 22p. Order from OTS. 75 cents. NAA-SR-4433

A transistorized six-channel airborne strain gage calibrator and excitation unit, by R. H. Gablehouse and C. E. Erickson. Sandia Corp., Albuquerque, N. Mex. Nov 59. 22p. Order from OTS. 75 cents. SCR-128

Flying spot scanner investigation, by E. J. Bernard and E. L. Checketts. Sandia Corp., Albuquerque, N. Mex. June 59. 32p. Order from LC. Mi $3.00, ph $6.30. SCTM-120-59(15)

Transistorized audio amplifier PA-2W-1A, by M. H. Brock. Sandia Corp., Albuquerque, N. Mex. May 59. 10p. Order from LC. Mi $1.80, ph $1.80. SCTM-164-59-52

Power supply, by M. H. Brock. Sandia Corp., Albuquerque, N. Mex. May 59. 10p. Order from LC. Mi $1.80, ph $1.80. SCTM-165-59-(52)

Reliability considerations in circuit design, by A. M. Breipohl. Sandia Corp., Albuquerque, N. Mex. July 59. 21p. Order from LC. Mi $2.70, ph $4.80. SCTM-226-59-(15)

A large bakeable vacuum valve, by R. H. Batzer. University of California. Lawrence Radiation Lab., Livermore, Calif. Aug 59. Contract W-7405-eng-48. 13p. Order from LC. Mi $2.40, ph $3.30. UCRL-5649

Liquid-hydrogen target, by D. D. Newhart, V. Perez-Mendez, and W. L. Pope. University of California, Lawrence Radiation Lab., Berkeley, Calif. Aug 59. Contract W-7405-eng-48. 15p. Order from OTS. 75 cents. UCRL-8857

Isotopes-Industrial Technology

Expanding the utilization of radioisotopes and nuclear techniques in food toxicology and processing, by J. H. Rust. Massachusetts Institute of Technology, Dept. of Food Technology, Cambridge, Mass. Nov 59. Contract AT(30-1) 2309. 61p. Order from OTS. 75 cents. AECU-4327

Radioisotopes at work for agriculture, by A. G. Homan and R. R. Tarrice. Stanford Research Institute, Menlo Park, Calif. Oct 59. Contract AT(04-3)-115. 198p. Order from OTS. $3.50. SRIA-9

Radiation application and fission product utilization. A bibliography of selected unclassified literature, by G. A. Young. U. S. Atomic Energy Commission, Office of Isotopes Development, Washington, D. C. July 59. 187p. Order from OTS. $1.75. TID-3046 (Suppl. 2)

Industrial applications of radioisotpes and associated techniques. A literature search, by R. L. Scott. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Nov 59. 30p. Order from OTS. 75 cents. TID-3539

Metallurgy and Ceramics

The determination of the equilibrium phase diagram, zirconium-niobium. Period covered: July 1 to August 1, 1959, by C. E. Lundin. University of Denver, Denver Research Institute, Denver, Colo. Aug 59. Contract AT(11-1)-752. 5p. Order from LC. Mi $1.80, ph $1.80. AECU-4284

Study of factors influencing ductility of iron-aluminum alloys. Period covered: March 15, 1959 to March 15, 1960, by F. C. Perkins and J. F. Nachman. University of Denver. Denver Research Institute, Denver, Colo. Aug 59. Contract AT(11-1)-742. 9p. Order from LC. Mi $1.80, ph $1.80. AECU-4290

Adsorption of silicic acid on thoria-determined by infrared spectroscopy. Technical report no. V, by G. J. Spaepen, R. T. Wimber, and M. E. Wadsworth. University of Utah. Institute of Metals and Explosives Research, Salt Lake City, Utah. June 59. Contract W-7405-eng-26. 38p. Order from LC. Mi $3.00, ph $6.30. AECU-4299

Bonding uranium carbide to tantalum, by M. G. Bowman. Los Alamos Scientific Lab., Los Alamos, N. Mex. May 59. 2p. Order from LC. Mi $1.80, ph $1.80. AECU-4303

Ultrasonic power requirements for processing LMFR blanket to produce equiaxed thorium bismuthide particles, by W. B. Tarpley, C. D. McKinney, Jr., and J. G. Thomas. Aeroprojects, Inc., West Chester, Pa. Apr 59. Contract AT-30-2-GEN-16. 47p. Order from LC. Mi $3.30, ph $7.80. AECU-4333

Measurements of mechanical properties of pure and uranium-loaded graphites at elevated temperatures. Final report for June 27,. 1957 through December 15, 1958, by L. Green, Jr., M. L. Stehsel, and C. E. Waller. Aerojet-General Corp., Azusa, Calif. Dec 58. [Sub] contract CTU-86039-1. 145p. Order from LC. Mi $7.20, ph $22.80. AGC-1537

Irradiation of extrusion-clad uranium-2 w/o zirconium alloy for EBR-I, Mark III, by J. H. Kittel. Argonne National Laboratory, Lemont Ill. Oct 59. Contract W-31-109-eng-38. 18p. Order from OTS. 75 cents. ANL-5918

Modification of CP-5 fuel assemblies for fuel capsule irradiation experiments, by W. N. Beck, J. H. Kittel and F. L. Brown. Argonne National Laboratory, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 24p. Order from OTS. 75 cents. ANL-6041

Examination of jacketed uranium slugs from the Los Alamos fast reactor "Clementine", by S. H. Paine, W. F. Murphy, and F. L. Brown. Argonne National Laboratory, Lemont, Ill. Oct 59. Contract W-31-109-eng-38. 17p. Order from OTS. 75 cents. ANL-6048

Examination of irradiated experimental NRU fuel rods, by S. H. Paine and W. F. Murphy. Argonne National Laboratory, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 26p. Order from OTS. 75 cents. ANL-6059

Experimental and theoretical studies of the solidification of uranium castings, by E. L. Foster, Jr., B. L. Fletcher, C. K. Franklin, A. Lechler, and R. F. Dickerson. Battelle Memorial Institute, Columbus, Ohio. Oct 59. Contract W-7405-eng-92. 61p. Order from OTS. $1.75. BMI-1390

Metallurgical studies of niobium-uranium alloys, by J. A. DeMastry, F. R. Shober, and R. F. Dickerson. Battelle Memorial Institute,

Columbus, Ohio. Dec 59. Contract W-7405-eng-92. 44p. Order from OTS. $1.25. BMI-1400

Metallographic examination of L6Z-114 in-pile autoclave pins, by A. E. Richt. Oak Ridge National Laboratory, Oak Ridge, Tenn. Feb 58. Contract W-7405-eng-26. 10p. Order from LC. Mi $1.80, ph $1.80. CF-58-2-15

Application of electroless-nickel brazing to tubular fuel elements for the N. S. Savannah. Status report, by J. T. Lamartine and W. C. Thurber. Oak Ridge National Laboratory, Oak Ridge, Tenn. June 59. Contract W-7405-eng-26. 31p. Order from LC. Mi $3.00, ph $6.30. CF-59-6-55

Run 300A-8 initial slurry run of 300A pump and loop, by J. C. Moyers. Oak Ridge National Laboratory, Oak Ridge, Tenn. July 59. Contract W-7405-eng-26. Order from LC. Mi $1.80, ph $1.80. CF-59-7-35

Secondary-side water treatment for corrosion control in aluminum heat exchangers: Practices and results at the Oak Ridge Research Reactor, by P. D. Neumann. Oak Ridge National Laboratory, Oak Ridge, Tenn. Aug 59. Contract W-7405-eng-26. 19p. Order from LC. Mi $2.40, ph $3.30. CF-59-8-50

Corrosion in hydrogen sulfide-water systems, by J. A. Snyder and D. Warren. Du Pont de Nemours (E.I.) & Co., Engineering Research Laboratory, Wilmington, Del. Oct 55. Decl. Mar. 7, 1957. Contract AT(07-2)-1. 240p. Order from LC. Mi $11.10, ph $37.80. DP-96

Corrosion of zirconium, carbon steel, and stainless steel in high temperature water, by R. J. Lobsinger. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Aug 58. Contract W-31-109-Eng-52. 11p. Order from LC. Mi $2.40, ph $3.30. HW-56995

Final report, design test PR-24 PRTR calandria shroud tube bellows, by H. L. Floyd. Hanford Atomic Products Operation, Richland, Wash. Aug 59. Contract AT(45-1)-1350. 22p. Order from OTS. 75 cents. HW-58801 REV

Photographic observations of the growth of uranium dioxide crystals by vapor deposition, by H. W. Newkirk and J. L. Bates. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. Mar 59. 10p. Order from LC. Mi $1.80, ph $1.80. HW-59575

Hydrogen effects on Zircaloy-2 tensile properties, by H. H. Burton. Hanford Atomic Products Operation, Richland, Wash. July 59. Contract W-31-109-Eng-52. 52p. Order from OTS. $1.50. HW-61077

The law of oxidation of metallic cerium generalization to other metals, by J. Loriers. Translated by C. Groot. Hanford Atomic Products Operation, Richland, Wash. Sep 59. Contract AT(45-1)-1350. 8p. Order from OTS. 50 cents. HW-61492

Oxidation of metallic uranium, by J. Loriers. Translated by C. Groot. Hanford Atomic Products Operation, Richland, Wash. Sep 59. Contract AT(45-1)-1350. 8p Order from OTS. 50 cents. HW-61493

Vanadium-chromium alloy system, by O. N. Carlson and A. L. Eustice. Iowa State University of Science and Technology, Ames Laboratory, Ames, Iowa. Nov 59. Contract W-7405-eng-82. 17p. Order from OTS. 75 cents. IS-47

Examination of welds in hafnium "wye" control rods, by A. C. Cooley and W. E. Ray. Knolls Atomic Power Laboratory, Schenectady, N. Y. Aug 59. Contract W-31-109-Eng-52. 16p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-ACC-3

Swaged metal fiber-UO_2 fuel element. First quarterly progress report. From December 22, 1958 to March 15, 1959, by L. Sundquist. Martin Company, Nuclear Division, Baltimore, Md. Apr 59. Contract AT(30-1)-2220, Task III. 37p. Order from OTS. $1.00. MND-SF-1714

Swaged metal fiber-UO_2 fuel element. Second quarterly progress report. From March 15, 1959 to June 15, 1959, by L. Sundquist. Martin Company, Nuclear Division, Baltimore, Md. July 59. Contract AT(30-1)-2220, Task III. 44p. Order from OTS. $1.50. MND-SF-1768

Swaged metal fiber-UO_2 fuel element. Third quarterly progress report. From June 15, 1959 to September 15, 1959, by J. Kane. Martin Company, Nuclear Division, Baltimore, Md. Oct 59. Contract AT(30-1)-2220. Task III. 58p. Order from OTS. $1.75. MND-SF-1769

Processing refabrication experiment (PRE) program bibliography, by G. L. Schalin. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 13p. Order from LTS. 50 cents. NAA-SR-3703

Factors affecting yield and metal quality in the reduction of UF_4 to metal, by O. R. Magoteaux and C. C. Smitherman. National Lead Company, Technical Division, Cincinnati, Ohio. Dec 59. Contract AT(30-1)-1156. 17p. Order from OTS. 75 cents. NLCO-794

Scoping studies on electrolytic reduction of magnesium fluoride, by R. B. Steck and V. G. Minutolo. National Lead Company of Ohio. Technical Division, Cincinnati, Ohio. Jan 60. Contract AT (30-1)-1156. 26p. Order from OTS. $1.00. NLCO-796

Cast hollow fuel rods, by E. M. Avallone, A. R. Kaufmann, and J. E. Roman. Nuclear Metals, Inc., Concord, Mass. July 59. Contract AT (30-1)-1565. 17p. Order from LC. Mi $2.40, ph $3.30. NMI-1224

Evaluation of Zircaloy-clad-U-2 w/o Zr alloy tube no. 32, extrusion no. 18392, by D. F. Kaufman and R. G. Jenkins. Nuclear Metals, Inc., Concord, Mass. Apr 59. Contract AT(30-1)-1565. 37p. Order from LC. Mi $3.00, ph $6.30. NMI-4378

Power reactor program. Progress report to E. I. du Pont de Nemours and Company for the period February 1, 1959 through February 28, 1959, by S. Isserow and others. Nuclear Metals, Inc., Concord, Mass. June 59. Contract AT(30-1)-1565. 35p. Order from LC. Mi $3.00, ph $6.30. NMI-4386

Corrosion behavior of fuel elements with U-2 w/o Zr core clad with Zircaloy-2. Status report, by S. Isserow. Nuclear Metals, Inc., Concord, Mass. Apr 59. Contract AT(30-1)-1565. 40p. Order from LC. Mi $3.30, ph $7.80. NMI-4388

Twisted ribbon fuel element. Status report to E. I. du Pont de Nemours and Company, by A. R. Kaufmann. Nuclear Metals, Inc., Concord, Mass. June 59. Contract AT(30-1)-1565. 9p. Order from LC. Mi $1.80, ph $1.80. NMI-4390

Effects of thermal cycling on an integrally coextruded tubular fuel element of U-2 w/o Zr clad with Zircaloy-2. Final report to E. I. du Pont de Nemours and Co., by R. G. Jenkins. Nuclear Metals, Inc., Concord, Mass. Aug 59. Contract AT(30-1)-1565. 26p. Order from LC. Mi $2.70, ph $4.80. NMI-4391

Power reactor program. Progress report to E. I. du Pont de Nemours and Company for the period April 1, 1959 through April 30, 1959, by S. Isserow and others. Nuclear Metals, Inc., Concord, Mass. Aug 59. Contract AT(30-1)-1565 1565. 21p. Order from LC. Mi $2.70, ph $4.80. NMI-4393

Power reactor program: Progress report to E. I. du Pont de Nemours and Company for the period May 1, 1959 through May 31, 1959, by S. Isserow and others. Nuclear Metals, Inc., Concord, Mass. Aug 59. Contract AT(30-1)-1565. 26p. Order from LC. Mi $2.70, ph $4.80. NMI-4394

The corrosion resistance of several alloys in an HF-H_2O atmosphere at high temperatures, by C. F. Ritchie and E. K. Teter. Mallinckrodt Chemical Works, St. Louis, Mo. Jan 52. Decl. June 19, 1959. 15p. Order from LC. Mi $2.40, ph $3.30. NYO-1330

Study of the films formed on zirconium-niobium alloys in oxygen atmospheres. Final report, by O. Zmeskal and M. L. Brey. University of Florida. Engineering and Industrial Experiment Station, Gainesville, Fla. June 59. Contract AT(40-1)-1826. 106p. Order from LC. Mi $5.70, ph $16.80. ORO-204

A survey of the literature on the elastic constants of barium titanate ceramics, by R. A. Graham. Sandia Corp., Albuquerque, N. Mex. June 59. 14p. Order from LC. Mi $2.40, ph $3.30. SCTM-206-59(51)

Graphite. A literature search, by T. F. Davis. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Oct 59. 82p. Order from OTS. $2.25. TID-3532

Pressure testing of Zircaloy tubing, by L. F. Cochrun. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh, Pa. Oct 59. Contract AT-11-1-GEN-14. 39p. Order from OTS. $1.25. WAPD-216

Deposition of corrosion products under irradiation Van de Graaf study, Interim report no. 4, by G. P. Simon. Westinghouse Electric Corp., Bettis Plant, Pittsburgh, Pa. Oct 58. 26p. Order from LC. Mi $2.70, ph $4.80. WAPD-CDA-(AD)-466

Annihilation of nuclei by displacement spikes, by D. E. Thomas. Westinghouse Electric Corp., Bettis Plant, Pittsburgh, Pa. Nov 57. 8p. Order from LC. Mi $1.80, ph $1.80. WAPD-IPC-743

Report on PWR experiment 11a5 the corrosion testing of platelets of varying cladding thickness, by E. L. Richards. Westinghouse Electric Corp., Atomic Power Div., Pittsburgh, Pa. Mar 54. Cecl. Aug. 25, 1958. 23p. Order from LC. Mi $2.70, ph $4.80. WAPD-MP-547

Location of residual spacer material in subassemblies. Inspection development report, by R. A. Betz. Westinghouse Electric Corp., Bettis Plant, Pittsburgh, Pa. May 59. 14p. Order from LC. Mi $1.80, ph $1.80. WAPD-NCQ-(DR)-7

Investigation of stretch-forming process for fabrication of reactor fuel elements, by M. D'Amore. Westinghouse Electric Corp., Atomic Power Department, Pittsburgh, Pa. Sep 59. Contract AT(30-3)-222. 38p. Order from OTS. $1.25. YAEC-146

Physics and Mathematics

Progress report for research on heat transfer to fluids flowing through non-circular channels, by J. P. Hartnett and C. Y. Koh. University of Minnesota, Minneapolis, Minn. June 59. Contract AT(11-1)-659. 12p. Order from LC. Mi $2.40, ph $3.30. AECU-4167

Technical progress report. Part I. High-speed computer program. Part II. Mathematical methods. Part III. Illiac use and operation. Part IV. IBM 650 use and operation. Part V. General laboratory information. University of Illinois. Digital Computer Lab., Urbana, Ill. Mar 59. Contract AT(11-1)-415. and Contract Nonr-1834 (15). 24p. Order from LC. Mi $2.70, ph $4.80. AECU-4235

Technical progress report. Part I. High-speed computer program. Part II. Switching circuit theory. Part III. Illiac use and operation. Part IV. IBM 650 use and operation. Part V. General laboratory information. University of Illinois. Digital Computer Lab., Urbana, Ill. Apr 59. Contract AT(11-1)-415 and Contract Nonr-1834 (15). 37p. Order from LC. Mi $3.00, ph $6.30. AECU-4236

Bibliography of neutron yields from the reactions p + T, d + T (1954 to September 1957), by S. Harris and H. Stearns. Los Alamos Scientific Lab., Los Alamos, N. Mex. [1957]. Contract W-7405-eng-36. 8p. Order from LC. Mi $1.80, ph $1.80. AECU-4246

Field distribution, by R. M. Hendrickson. Los Alamos Scientific Lab., Los Alamos, N. Mex. June 59. Contract W-7405-eng-36. 155p. Order from LC. Mi $7.50, ph $24.30. AECU-4248

Radiation effect of positive ion bombardment. Progress report for March 16, 1959 to June 15, 1959 and Annual report for June 15, 1958 to June 15, 1959, by R. L. Hines. Northwestern University, Evanston, Ill. July 59. Contract (11-1)-89. 5p. Order from LC. Mi $1.80, ph $1.80. AECU-4251

Tables of cross sections for π^+ photo-production from hydrogen, according to the theory of Chew, Goldberger, Low and Nambu. Technical report no. 8, by C. S. Robinson. University of Illinois. Physics Research Lab., Urbana, Ill. May 59. Contract Nonr-1834(05). 33p. Order from LC. Mi $3.00, ph $6.30. AECU-4272

Elastic modulus of isotopically concentrated lithium, by W. M. Robertson and D. J. Montgomery. Michigan State University, East Lansing, Mich. 1959. Contract AT(11-1)-400. 17p. Order from LC. Mi $2.40, ph $3.30. AECU-4281

Status report on a study of the use of furnace calorimetry for the rapid determination of specific heat of solids at high temperatures, by J. H. Boggs, R. A. Knezek, and J. A. Wiebelt. Oklahoma State University, School of Mechanical Engineering, Stillwater, Okla. Aug 59. Contract AT(11-1)-71. 13p. Order from LC. Mi $2.40, ph $3.30. AECU-4282

Research and investigation leading to methods of generating and detecting radiation in the 100 to 1000 micron wavelength range of the spectrum. Quarterly progress report no. 13 for March 1, 1959 to June 1, 1959, by P. D. Coleman and others. University of Illinois. Electrical Engineering Research Lab., Urbana, Ill. July 59. Contract AT(11-1)-392. 44p. Order from LC. Mi $3.30, ph $7.80. AECU-4293

Technical progress report. Part I. High-speed com computer program. Part II. Mathematical methods. Part III. Illiac use and operation. Part IV. IBM 650 use and operation. Part V. General laboratory information. University of Illinois. Digital Computer Lab., Urbana, Ill. June 59. Contracts AT(11-1)-415 and Nonr-1834(15). 31p. Order from LC. Mi $3.00, ph $6.30. AECU-4307

The arithmetic unit. Report no. 92, by D. J. Wheeler. University of Illinois. Digital Computer Lab., Urbana, Ill. Aug 59. Contract AT(11-1)-415. 29p. Order from LC. Mi $2.70, ph $4.80. AECU-4318

An investigation of certain thermodynamic and transport properties of water and water vapor in the critical region, by E. S. Nowak and R. J. Grosh. Argonne National Laboratory, Lemont, Ill. Oct 59. Contract W-31-109-eng-38. 102p. Order from OTS. $2.50. ANL-6064

Nuclear excursion analysis on the IBM 650 (Early code), by E, M. Reiback and C. J. Stueck. Alco Products, Inc., Schenectady, N. Y. Feb 59. Rev. July 1959. 16p. Order from LC. Mi $2.40, ph $3.30. APAE-Memo-177(Rev.)

The determination of the diffusion coefficientofa gas-metal system, by V. L. Gelezunas. General Electric Co. Atomic Products Division, Aircraft Nuclear Propulsion Dept., Cincinnati, Ohio. Sep 57. Contracts AF 33(600)-38062 and AT(11--1)-171. 16p. Order from OTS. 50 cents. APEX-409

An IBM 704 program report, Aircraft Nuclear Propulsion shielding program 10-0, by J. W. Haffner, J. J. Loechler, and J. E. MacDonald. General Electric Co., Atomic Products Division, Aircraft Nuclear Propulsion Dept., Cincinnati, Ohio. Mar 1958. Contracts AF 33(600)-38062 and AT(11-1)-171. 36p. Order from OTS. $1.25. APEX-503

IBM 650 routine V a multigroup P_3 program for the neutron transport equation, by R. R. Haefner. E. I. du Pont de Nemours & Co., Theoretical Physics Division, Savannah River Laboratory, Aiken, S. C. Oct 59. Contract AT(07-2)-1. 63p. Order from OTS. $1.75. DP-427

SYZYGY, a code for calculating the thermal neutron flux spectrum near a temperature discontinuity, by J. E. Schlosser. Hanford Atomic Products Operation, Richland, Wash. Aug 59. Contract AT(45-1)-1350. 57p. Order from OTS. $1.75. HW-61042

Semi-annual summary research report in physics for January-June 1959, by Ames Laboratory Staff. Iowa State University of Science and Technology, Ames Laboratory, Ames, Iowa. Oct 59. Contract W-7405-eng-82. 55p. Order from OTS. $1.50. IS-14

Evaluation of blast and shock effects on tunnel support structures, by A. A. Lee and E. Y. Wong. Holmes & Narver, Inc., Los Angeles, Calif. May 59. 35p. Order from OTS. $1.00. ITR-1714

An IBM 704 program for the computation of cross-section in gamma-ray zero-zero transitions in nuclei, by R. E. Mills and R. M. Kloepper. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Dec 59. Contract W-7405-ENG-36. 20p. Order from OTS. 75 cents. LAMS-2359

Reactor kinetics. A bibliography, by M. Bloomfield and F. G. Bennett IV. Atomics International, A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 56p. Order from OTS. $1.50. NAA-SR-3808

Neutron flux distributions in organic moderated reactor cores, by V. A. Swanson. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 21p. Order from OTS. 75 cents. NAA-SR-4184

Tolerance comparator, by P. A. Nicovich. Sandia Corporation, Albuquerque, N. Mex. Aug 59. 4p. Order from OTS. $5.25. SCR-112

Isotopic power and thermionic conversion. A literature search, by R. L. Scott. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Dec 59. 12p. Order from OTS. 50 cents. TID-3540

A table of emission lines in the vacuum ultraviolet for all elements (6 angstroms to 2000 angstroms) R. L. Kelly. Univ. of California. Lawrence Radiation Lab. Livermore, Calif. n. d. 523p. Order from OTS. $7.00. UCRL-5612

The lifetime and decay modes of negative K mesons, by N. A. Nickols. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Sep 59. Contract W-7405-eng-48. 52p. Order from OTS. $1.25. UCRL-8692

The cross section for compound-nucleus formation in heavy-ion-induced reactions, by T. D. Thomas University of California. Lawrence Radiation Lab., Berkeley, Calif. Apr 59. Contract W-7405-eng-48. 36p. Order from LC. Mi $3.00, ph $6.30. UCRL-8695

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Temperature coefficients of a highly enriched core in slab geometry, by S. L. Shufler, W. F. Vogelsang, R. S. Wick and H. I. Dolnick. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh, Pa. Oct 59. Contract AT-11-1-GEN-14. 30p. Order from OTS. $1.00. WAPD-TM-128

SPIC-1 -- An IBM-704 code to calculate the neutron distribution outside a right-circular cylindrical source, by P. Gillis. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh, Pa. Nov 59. Contract AT-11-1-GEN-14. 12p. Order from OTS. 50 cents. WAPD-TM-196

Progress Reports

Semi-annual progress report for January 1, 1959 to July 31, 1959, by M. C. Bell and others. University of Tennessee. Atomic Energy Commission, Agricultural Research Lab., Oak Ridge, Tenn. Dec 59. Contract AT-40-1-GEN-242. 58p. Order from OTS. $1.75. ORO-217

Radiation Effects on Materials

Radiation effects on selected structural metals. A literature search, by W. E. Bost. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Nov 59. 17p. Order from OTS. 50 cents. TID-3538

Radiochemistry of the PWR fuel material cycling tests (WAPD-29-1 and -2) in the WAPD-29 VH-3 loop of the materials testing reactor, by R. Ehrenreich. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh, Pa. Nov 59. Contract AT-11-1-GEN-14. 21p. Order from OTS. 75 cents. WAPD-TM-159

Radioactive Waste

Interim report on tests performed at the K reactors to effectively decontaminate the process piping by an internal chemical flush, by H. F. Jensen. General Electric Co., Handord Atomic Products Operation, Richland, Wash. May 58. Contract W-31-109-Eng-52. 13p. Order from LC. Mi $2.40, ph $3.30. HW-56001

Field experiments with model crib. I. Location, facility design and first experiment, by K. C. Knoll and J. L. Nelson. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. Aug 59. Contract AT(45-1)-1350. 15p. Order from LC. Mi $2.40, ph $3.30. HW-61476

Reactors—General

Circulating loops for testing organic coolants. Survey and status, by J. G. Carroll. California Research Corp., Richmond, Calif. June 59. Contract AT(11-1)-174. 74p. Order from LC. Mi $4.50, ph $12.30. AECU-4326

Shock impingement experiments on crushable solids, by P. Lieberman. Illinois Institute of Technology, Armour Research Foundation, Technology Center, Chicago, Ill. June 59. Contract AT(11-1)-528. 98p. Order from OTS. $2.50. ARF-4132-10

Studies of reactor containment. Summary report no. 1 for February 1, 1959 to July 31, 1959, by T. A. Zaker. Illinois Institute of Technology. Armour Research Foundation, Technology Center, Chicago, Ill. Aug 59. Contract AT(11-1)-528. 80p. Order from OTS. $2.25. ARF-4132-11

Final report on design tests PR-50 and PR-51 reactor piping seal testing and reactor piping structural integrity, by P. M. Jackson. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. June 59. Contract W-31-109-Eng-52. 61p. Order from OTS. $1.75. HW-60899

Plutonium recycle test reactor final safeguards analysis, by N. G. Wittenbrock and others. General Electric Co., Hanford Atomic Products Operation, Reactor Engineering Development Operation, Richland, Wash. Oct 59. Contract AT(45-1)-1350. 313p. Order from OTS. $5.00. HW-61236

Quarterly progress report for January, February, March, 1959, by W. E. Nyer and others. Phillips Petroleum Co., Atomic Energy Division, Idaho Operations Office, Idaho. Nov 59. Contract AT(10-1)-205. 66p. Order from OTS. $1.75. IDO-16539

MTR-ETR Technical Branches quarterly report. Period ending June 30, 1959, by J. R. Huffman and others. Phillips Petroleum Company, Atomic Energy Division, Idaho Operations Office, Idaho. Nov 59. Contract AT(10-1)-205. 77p. Order from OTS. $2.00. IDO-16561

Heat transfer in ETR fuel assemblies for cycle 13, by V. A. Walker. Phillips Petroleum Co., Atomic Energy Division, Idaho Operations

Office, Idaho. Nov 59. Contract AT(10-1)-205. 24p. Order from OTS. 75 cents. IDO-16562

Nuclear reactor simulation by analog computer. A literature survey, by R. J. Allen, F. G. Bennett, IV, and R. N. Cordy. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Dec 59. Contract AT(11-1)-GEN-8. 56p. Order from OTS. $1.75. NAA-SR-3708

Gamma-ray and fast neutron annular streaming evaluation through sodium reactor experiment (SRE) Mark II control and safety rod assemblies, F. D. Anderson and others. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Oct 59. Contract AT(11-1)-GEN-8. 30p. Order from OTS. $1.00. NAA-SR-3989

Sodium reactor experiment (SRE) shielding evaluation for thermal neutron streaming at reactor vessel coolant pipe penetrations, by F. D. Anderson and others. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Oct 59. Contract AT(11-1)-GEN-8. 56p. Order from OTS. $1.50. NAA-SR-3990

Fuel cycles in nuclear reactors, by R. T. Shanstrom, M. Benedict, and C. T. McDaniel. Massachusetts Institute of Technology, Nuclear Engineering Dept., Cambridge, Mass. Aug 59. Contract AT(30-1)-2073. 397p. Order from OTS. $4.00. NYO-2131

Dispersions of uranium carbides in aluminum plate-type research reactor fuel elements, by W. C. Thurber and R. J. Beaver. Oak Ridge National Laboratory, Metallurgy Division, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 49p. Order from OTS. $1.50. ORNL-2618

Design of chemical processing plant for homogeneous reactor test, by A. M. Rom and H. O. Weeren. Oak Ridge National Laboratory, Chemical Technology Division, Process Design Section, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 105p. Order from OTS. $2.50. ORNL-2784

Gas-cooled reactors. Bibliography, by W. H. Richardson and F. Strachwitz. Sandia Corporation, Albuquerque, N. Mex. Sep 59. 216p. Order from OTS. $3.50. SCR-86

Containment of fragments from runaway reactor, by G. B. Huber and N. R. Zabel. Stanford Research Institute, Menlo Park, Calif. June 59. Contract AT(04-3)-115. 86p. Order from OTS. $2.25. SRIA-10

Reactor safety. A literature search, by R. J. Smith. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Nov 59. 41p. Order from OTS. $1.25. TID-3525(Rev. 1)

The calculation of pressure drop and flow distribution within a reactor vessel in a pressurized water nuclear reactor system, by J. S. Busch, L. L. Lynn, and C. F. Bonilla. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh, Pa. Aug 59. Contract AT-11-1-GEN-14. 43p. Order from OTS. $1.25. WAPD-217

Multi-region reactor lattice studies. Quarterly progress report for the period June 1 to September 30, 1959, by I. H. Coen. Westinghouse Electric Corp., Atomic Power Dept., Pittsburgh, Pa. Oct 59. Contract AT(30-1)-2176. 23p. Order from OTS. 75 cents. WCAP-1404

Reactors—Power

Pathfinder Atomic Power Plant radiation shielding study, by R. Corcoran, H. C. Crumpacker, and D. M. Leppke. Allis-Chalmers Mfg. Co., Atomic Energy Div., Milwaukee, Wis. June 59. Contract AT(11-1)-589. 44p. Order from LC. Mi $3.30, ph $7.80. ACNP-5912

Pathfinder Atomic Power Plant measurements of nuclear parameters of boiler and superheater lattices, by A. Jacobs and R. H. Vollmer. Pennsylvania State University, University Park, Pa., and Allis-Chalmers Mfg. Co., Atomic Energy Div., Milwaukee, Wis. Aug 59. Contract AT(11-1)-589. 27p. Order from LC. Mi $2.70, ph $4.80. ACNP-5918

Component cooling water system. Section III. Part VI-F. Third performance. Duquesne Light Co., Shippingport, Pa. June 59. 5p. Order from LC. Mi $1.80, ph $1.80. AECU-4256

Safety radiation level survey. Section II. Fourth performance. Duquesne Light Co., Shippingport, Pa. June 59. 7p. Order from LC. Mi $1.80, ph $1.80. AECU-4258

Intercalibration of nuclear instrumentation. Section IV. Second performance. Duquesne Light Co., Shippingport, Pa. June 59. 6p. Order from LC. Mi $1.80, ph $1.80. AECU-4259

Measurements of coefficients of reactivity. Section I. 300 EFPH. Third performance. Duquense Light Co., Shippingport, Pa. June 59. 42p. Order from LC. Mi $3.30, ph $7.80. AECU-4260

Determination of coefficients of reactivity. Section I. 1692.8 EFPH. Fifth performance. Duquesne Light Co., Shippingport, Pa. June 59. 42p. Order from LC. Mi $3.30, ph $7.80. AECU-4261

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Core instrumentation calibration. Section V. Fifth performance. Duquesne Light Co., Shippingport, Pa. June 59. 14p. Order from LC. Mi $2.40, ph $3.30. AECU-4263

Periodic radiation survey of reactor plant container and components after shutdown "F" survey. Section IV. Second performance. Duquesne Light Co., Shippingport, Pa. June 59. 4p. Order from LC. Mi $1.80, ph $1.80. AECU-4264

Reactivity lifetime (1000 hour run). Section III. First performance. Duquesne Light Co., Shippingport, Pa. June 59. 119p. Order from LC. Mi $6.00, ph $18.30. AECU-4265

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Status of pressurized water reactor reactivity accident analysis, by L. Geller, J. Cagnetta, and R. Dobbs. Vitro Engineering Co., New York, N. Y. Mar 58. Subcontract 73(14-1025). 19p. Order from LC. Mi $2.40, ph $3.30. AECU-4312

Monthly operating report. Duquesne Light Co., Shippingport, Pa. July 59. Contract AT-11-1-292. 38p. Order from LC. Mi $3.00, ph $6.30. AECU-4323

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Heavy water components test reactor. Papers presented to the American Nuclear Society on June 17, 1959, by L. M. Arnett. E. I. du Pont de Nemours & Co., Explosives Dept., Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. Oct 59. Contract AT(07-2)-1. 36p. Order from OTS. $1.00. DP-413

Heavy water moderated power reactors. Progress report for August 1959, by D. F. Babcock and L. Isakoff. E. I. du Pont de Nemours & Co., Explosives Dept., Atomic Energy Div., Technical Div., Wilmington, Del. Oct 59. Contract AT(07-2)-1. 59p. Order from OTS. $1.75. DP-415

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Water level corrections for gage glass installations in nuclear plant service, by J. C. Westmoreland. Knolls Atomic Power Lab., Schenectady, N. Y. July 59. Contract W-31-109-Eng-52. 35p. Order from LC. Mi $3.00, ph $6.30. KAPL-M-SMS-101

Los Alamos molten plutonium reactor experiment (LAMPRE) hazard report, by E. O. Swickard and others. The University of California, Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Dec 59. Contract W-7405-ENG-36. 115p. Order from OTS. $2.75. LA-2327

Control of oxygen concentration in a large sodium system, by R. B. Hinze. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Dec 59. Contract AT(11-1) GEN-8. 46p. Order from OTS. $1.50. NAA-SR-3638

Self-sustaining plutonium recycle in sodium graphite reactors, by T. J. Connolly. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Sep 59. Contract AT(11-1)-GEN-8. 43p. Order from OTS. $1.25. NAA-SR-3912

Preliminary test of natural-circulation double-tube steam generator, by R. D. Welsh. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Dec 59. Contract AT(11-1)-GEN-8. 32p. Order from OTS. $1.00. NAA-SR-3969

Hazards analysis of the organic moderated reactor experiment, by R. O. Williams, Jr., and others. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Dec 59. Contract AT(11-1)-GEN-8. 255p. Order from OTS. $4.00. NAA-SR-4065

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SRE fuel element damage. An interim report, by A. A. Jarrett and others. Atomics International A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 181p. Order from OTS. $3.00. NAA-SR-4488

Core parameter survey report for organic cooled reactors, by R. W. Hardy and B. L. Hoffman. Atomics International. A Division of North American Aviation, Inc., Canoga, Park, Calif. Dec 59. Contract AT(11-1)-GEN-8. 49p. Order from OTS. $1.50. NAA-SR-4510

Solubility relations among rare-earth fluorides in selected molten fluoride solvents, by W. T. Ward, R. A. Strehlow, W. R. Grimes, and G. M. Watson. Oak Ridge National Laboratory, Reactor Chemistry Division, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 15p. Order from from OTS. 75 cents. ORNL-2749

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20,000 kilowatt organic moderated power plant. U. S. Atomic Energy Commission, Technical Information Service, Oak Ridge, Tenn. Oct 59. 132p. Order from OTS. $2.75. TID-8512

Report of the sodium heavy-water reactor task force, May 1959, by F. K. Pittman. U. S. Atomic Energy Commission, Civilian Reactors Evaluation and Planning Branch, Division of Reactor Development, Oak Ridge, Tenn. Oct 59. 38p. Order from OTS. 50 cents. TID-8515

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Comparison of various one-dimensional transport theory approximations, by P. H. Wackman. Westinghouse Electric Corp., Bettis Atomic Power Division, Pittsburgh, Pa. Oct 58. 3p. Order from LC. Mi $1.80, ph $1.80. WAPD-PWR-PL-494

Operation and testing of the Yankee universal fuel handling tool, by L. J. Balog. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh, Pa. June 59. Contract AT(30-3)-222. 40p. Order from LC. Mi $3.30, ph $7.80. YAEC-137

Monthly progress report for the period July 1 to July 31, 1959, by H. E. Walchli. Westinghouse Electric Corp., Atomic Power Dept., Pittsburgh, Pa. Aug 59. Contract AT(30-3)-222. 13p. Order from LC. Mi $2.40, ph $3.30. YAEC-157

Quarterly progress report for the period April 1 to June 30, 1959, by H. E. Walchli. Westinghouse Electric Corp., Atomic Power Dept., Pittsburgh, Pa. Aug 59. Contract AT(30-3)-222. 87p. Order from OTS. $2.25. YAEC-161

Stable Isotope Separation

Status report on heavy water production program. Design of production plant--hydrogen distillation processes, Hydrocarbon Research, Inc., Contract AT(30-1)-810. Design of Pilot and Production Plant and Construction of Pilot Plant --dual-temperature process, The Girdler Corp., Contract AT(30-1)-947. Atomic Energy Commission. New York Operations Office, New York, N. Y. June 50. Decl. Jan. 15, 1959. 64p. Order from LC. Mi $3.90, ph $10.80. NYO-699

Deuterium separation study. Progress report no. 2, by W. P. Drews. Esso Research and Engineering Co., Linden, N. J. Aug 55. Decl. Mar. 4, 1957. Contract AT(30-1)-1407. 77p. Order from LC. Mi $4.50, ph $12.30. NYO-6085(Rev.)

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Technology—Feed Materials

The application of diffusivity data in reducing the hydrogen content of gamma-extruded uranium bars, by H. W. Myers and others. Mallinckrodt Chemical Works, St. Louis, Mo. Dec 59. Contract W-14-108-Eng-8. 20p. Order from OTS. 75 cents. MCW-1439

The effect of uranium saturation on the extraction of elements other than uranium into tributyl phosphate, by G. P. Lang and J. T. Krieg. Mallinckrodt Chemical Works, St. Louis, Mo. Jan 60. Contract W-14-108-Eng-8. 17p. Order from OTS. 75 cents. MCW-1440